PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2001-018102**
(43)Date of publication of application : **23.01.2001**

(51)Int.CI. B23B 19/02
B23B 9/08
B23Q 39/04

(21)Application number : **11-193045**
(22)Date of filing : **07.07.1999**

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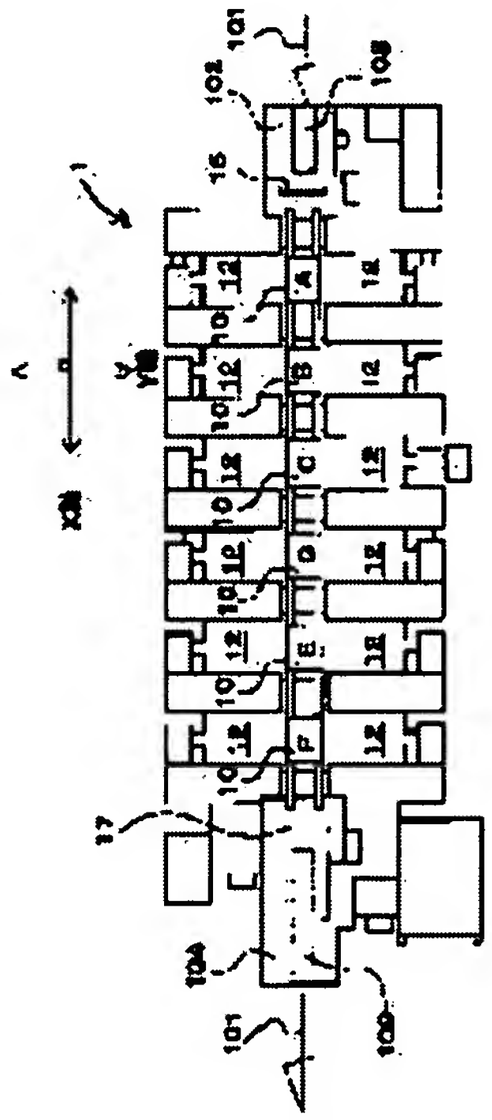
(54) **TRANSFER MACHINE**

(57)Abstract:
PROBLEM TO BE SOLVED: To cope with a fluctuation of production amount of engine cylinder head as a work or with changeover of engine cylinder head as a work.
SOLUTION: In each station A, B, C, D, E, F of a transfer machine 1, each single shaft (spindle) of two spindle heads arranged on a XZ axes feeding unit of each machine tool 12 arranged in sides of each station is connected to one motor by coupling. Each jig installed on each station A, B, C, D, E, F can freely control the inclination posture of an engine cylinder head while strongly holding it.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

(19)日本国特許庁（ＪＰ）

(12) **公開特許公報（A）**

(11)特許出願公開番号
特開2001－18102
（P2001－18102A）

(43)公開日　平成13年1月23日(2001.1.23)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード'（参考）
Ｂ２３Ｂ　19/02		Ｂ２３Ｂ　19/02	Ｄ	３Ｃ０４２
9/08		9/08		３Ｃ０４５
Ｂ２３Ｑ　39/04		Ｂ２３Ｑ　39/04	Ｚ	

審査請求　未請求　請求項の数６　ＯＬ　（全 24 頁）

(21)出願番号　特願平11－193045

(22)出願日　平成11年７月７日(1999.7.7)

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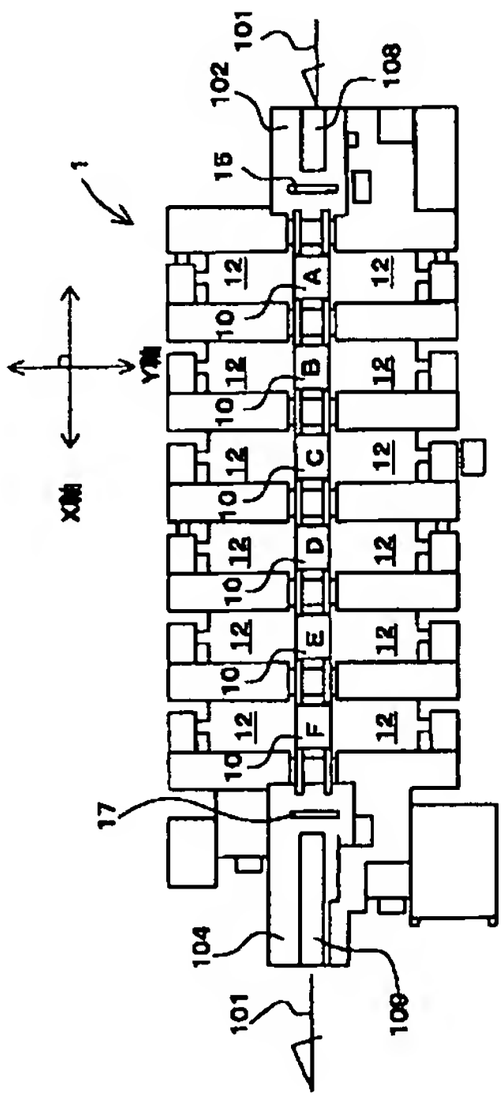
最終頁に続く

(54)【発明の名称】　トランスファマシン

(57)【要約】
【課題】　工作物であるエンジンシリンダヘッドの生産量の変動に対して、又は、工作物である「エンジンシリンダヘッドの切替」に対して、低コストで対応することができるトランスファマシンを提供すること。
【解決手段】　トランスファマシン１では、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、それらの横の工作機械１２のＸＺ軸送りユニット上に並べられた２個の主軸頭の単軸（スピンドル）のそれぞれが、１個のモータとカップリングで連結されている。そして、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上に設置される治具１０は、エンジンシリンダヘッドを固持しながらその傾斜姿勢を自由に制御することができる。



【特許請求の範囲】
【請求項１】　各ステーション上にエンジンシリンダヘッドが固定された際に、各ステーション横に並べられた複数のスピンドルの軸端にそれぞれ取り付けられた各工具を回転させながらＸＺ軸送りユニットで同時に送り出すことによって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで多数の機能孔を同時に加工するとともに、１個のエンジンシリンダヘッドを各ステーションへ順次に搬送することによって、１個のエンジンシリンダヘッドの機能孔に対する加工作業を各工程順に行うトランスファマシンにおいて、
１本のスピンドルのみを納めた単軸の主軸頭を前記ＸＺ軸送りユニット上に並べて各工具を同時に送り出すとともに、各主軸頭内の１本のスピンドルを１個のモータとカップリングで連結させて各工具を回転させることによって、前記ＸＺ軸送りユニット上に並べられる主軸頭の増減を自在とし、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の数を変更できることを特徴とするトランスファマシン。
【請求項２】　請求項１に記載するトランスファマシンにおいて、
前記主軸頭が並列的に固定されるハウジングを前記ＸＺ軸送りユニット上に取り付けることによって、前記ＸＺ軸送りユニット上に並べられる主軸頭のピッチ間隔を確保し、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔のピッチ間隔を保障したことを特徴とするトランスファマシン。
【請求項３】　請求項２に記載するトランスファマシンにおいて、
前記ハウジングを前記ハウジングと互換性のある他のハウジングに取り替えることによって、前記ＸＺ軸送りユニット上に並べられる主軸頭のピッチ間隔の設定を自在とし、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔のピッチ間隔を変更できることを特徴とするトランスファマシン。
【請求項４】　各ステーション上にエンジンシリンダヘッドが傾斜姿勢で固定された際に、各ステーション横に並べられた複数のスピンドルの軸端にそれぞれ取り付けられた各工具を回転させながらＸＺ軸送りユニットで同時に送り出すことによって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで多数の機能孔を同時に加工するとともに、１個のエンジンシリンダヘッドを各ステーションへ順次に搬送することによって、１個のエンジンシリンダヘッドの機能孔に対する加工作業を各工程順に行うトランスファマシンにおいて、
各ステーション上に設置される治具で前記エンジンシリンダヘッドを固持しながら前記エンジンシリンダヘッドの傾斜姿勢を制御することによって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の傾斜角度を変更できることを特徴とするトランスファマシン。
【請求項５】　請求項４に記載するトランスファマシンにおいて、
前記エンジンシリンダヘッドの位置決めを確保するためのロケートピンが設けられたロケート部材を前記治具に取り付け、前記ロケート部材を前記ロケート部材と互換性のある他のロケート部材に取り替えることによって、前記ロケートピンの配設状態を変更できることを特徴とするトランスファマシン。
【請求項６】　請求項４又は請求項５に記載するトランスファマシンにおいて、
前記エンジンシリンダヘッドを固持するためのクランプピンが設けられたクランプ部材を前記治具に取り付け、前記クランプ部材を前記クランプ部材と互換性のある他のクランプ部材に取り替えることによって、前記クランプピンの配設状態を変更できることを特徴とするトランスファマシン。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、エンジンシリンダヘッドの機能孔（ここでは、座面を形成するものも含む）を加工するトランスファマシンに関する。
【０００２】
【従来の技術】従来より、自動車等のエンジンの頭部であるエンジンシリンダヘッドには、燃焼室の一部（以下、単に「燃焼室」という）、ウォータージャケット、吸気バルブ・排気バルブを通す孔、ガス通路である吸気孔・排気孔、プラグをはめ込む孔、潤滑油の通路など、種々の機能孔が複雑に設けられている。例えば、図１４の平面図において、「燃焼室側」から示された６気筒４バルブのエンジンシリンダヘッド２００を、図１４のＰ－Ｐ線で切断してみると、図１５に示すようになり、種々の機能孔が複雑に設けられていることがわかる。尚、図１４においては、６個の「燃焼室」のそれぞれにおいて、２個の吸気バルブを通す孔と、２個の排気バルブを通す孔との合計４個の孔を見ることができる。
【０００３】そして、図１５に示すように、エンジンシリンダヘッド２００に収装された際の吸気バルブの軸線２０１（以下、単に「軸線２０１」という）回りに関しては、かかる「軸線２０１」を中心にして径の異なった機能孔２０１Ａ、２０１Ｂ、２０１Ｃが直列的に点在している。同様にして、エンジンシリンダヘッド２００に収装された際の排気バルブの軸線２０２（以下、単に「軸線２０２」という）回りに関しても、かかる「軸線２０２」を中心にして径の異なった機能孔２０２Ａ、２０２Ｂ、２０２Ｃが直列的に点在している。そこで、こ

のような「軸線２０１」や「軸線２０２」を中心にして直列的に点在しているという特性に着目して、これらの機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの加工は、さらに生産性などをも考慮して、トランスファ方式の生産システムで行っている。

【０００４】そして、かかるトランスファ方式の生産システムによる加工では、各ステーションの両側において、回転する複数の工具を同時に送り出すことをＸＺ軸で制御することにより行っている。その一方、エンジンシリンダヘッド２００においては、図１５に示すように、「軸線２０１」や「軸線２０２」は傾斜しており、加工対象の機能孔２０１Ａ、２０１Ｂ、２０１Ｃや、加工対象の機能孔２０２Ａ、２０２Ｂ、２０２Ｃは、傾いた状態において直列的に点在している。そこで、各ステーションにおいては、エンジンシリンダヘッド２００を傾斜姿勢に固定しており、これによって、エンジンシリンダヘッド２００の「軸線２０１」又は「軸線２０２」のいずれかを、回転する複数の工具の同時送り出し方向（Ｚ軸方向）にあわせている。

【０００５】具体的には、回転する複数の工具の同時送り出し方向（Ｚ軸方向）が水平である場合において、「軸線２０１」回りの機能孔２０１Ａ、２０１Ｂ、２０１Ｃを加工するときは、図１６に示すように、「軸線２０１」が水平となる傾斜姿勢で、エンジンシリンダヘッド２００を固定する。そして、このときは、「軸線２０１」はＸＺ軸で形成される平面上でＺ軸と平行な状態にある。一方、「軸線２０２」回りの機能孔２０２Ａ、２０２Ｂ、２０２Ｃを加工するときは、図１７に示すように、「軸線２０２」が水平となる傾斜姿勢で、エンジンシリンダヘッド２００を固定する。そして、このときは、「軸線２０２」はＸＺ軸で形成される平面上でＺ軸と平行な状態にある。

【０００６】尚、以下の説明の便宜上、図１６のエンジンシリンダヘッド２００の傾斜姿勢を「吸気側傾斜姿勢」と呼ぶ。また、図１７のエンジンシリンダヘッド２００の傾斜姿勢を「排気側傾斜姿勢」と呼ぶ。さらに、図１５のエンジンシリンダヘッド２００の姿勢を「正立姿勢」と呼ぶ。

【０００７】次に、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの加工をトランスファ方式の生産システムで行う従来技術のトランスファマシンについて、その概要を図面を参照にしながら説明する。図１８に、従来技術のトランスファマシン１００の概要を平面図で示す。かかるトランスファマシン１００においては、エンジンシリンダヘッド２００が搬送されるライン１０１上に、搬入部１０２、中間部１０３、搬出部１０４が設けられている。そして、搬入部１０２には、搬入用のローラコンベヤ１０８と姿勢変換装置１０５などが設けられいる。また、中間部１０３には、姿勢変換装置１０６などが設けられいる。また、搬出部１０４には、姿勢変換装置１０７と搬出用のローラコンベヤ１０９などが設けられている。

【０００８】さらに、搬入部１０２と中間部１０３との間には３つのステーションＡ、Ｂ、Ｃが設けられるとともに、各ステーションＡ、Ｂ、Ｃ上には治具１１０が設置されている。同様にして、中間部１０３と搬出部１０４との間にも３つのステーションＥ、Ｆ、Ｇが設けられるとともに、各ステーションＥ、Ｆ、Ｇ上には治具１１１が設置されている。そして、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆの両側には加工機械１１２が設けられいる。

【０００９】ここで、上述した姿勢変換装置１０５、１０６、１０７、治具１１０、１１１、加工機械１１２の概要について説明する。

【００１０】先ず、姿勢変換装置１０５、１０６、１０７の概要について、図１９を参照しながら説明する。図１９は、搬入部１０２に設けられた姿勢変換装置１０５の概要を示した正面図である。姿勢変換装置１０５は、保持部１２１、内枠１２２、シリンダ１２３、外枠１２４などからなる。保持部１２１は、エンジンシリンダヘッド２００をＬ字形のレール１２５と棒形のレール１２６で保持するものであり、内枠１２２の内側に設けられている。また、内枠１２２は、その外周が円弧形状をしたものであり、シリンダ１２３と回動可能に接続されている。他方、シリンダ１２３は、外枠１２４に回動可能に支持されている。また、外枠１２４には、内枠１２２の円弧形状の外周を案内する６個のガイドローラ１２７が設けられている。

【００１１】従って、シリンダ１２３のロッドが押し出されたり引き込まれたりすると、内枠１２２の外周が外枠１２４のガイドローラ１２７に案内され、内枠１２２は正方向又は逆方向に回転することになる。その結果、内枠１２２の内側に設けられた保持部１２１も、同様にして、正方向又は逆方向に回転することになる。これにより、「正立姿勢」で保持部１２１に保持されたエンジンシリンダヘッド２００を、保持部１２１に保持されたままで「吸気側傾斜姿勢」に変換することが可能となる。このとき、保持部１２１に保持されたエンジンシリンダヘッド２００の「正立姿勢」や「吸気側傾斜姿勢」は、外枠１２４に設けられたリミットスイッチ（図示せず）などで、内枠１２２の正方向又は逆方向に回転を停止させることにより保障されている。

【００１２】尚、中間部１０３に設けられた姿勢変換装置１０６の概要も同様であり、これにより、エンジンシリンダヘッド２００を「吸気側傾斜姿勢」から「排気側傾斜姿勢」に変換することが可能となる。また、搬出部１０４に設けられた姿勢変換装置１０７の概要も同様であり、これにより、エンジンシリンダヘッド２００を「排気側傾斜姿勢」から「正立姿勢」に変換することが

可能となる。
【００１３】次に、治具１１０、１１１の概要について、図２０を参照しながら説明する。図２０は、各ステーションＡ、Ｂ、Ｃに設置された治具１１０の概要を示した正面図である。治具１１０は、エンジンシリンダヘッド２００を「吸気側傾斜姿勢」で固持する固持部１３１を有している。かかる固持部１３１は、エンジンシリンダヘッド２００の一部が接面することより「吸気側傾斜姿勢」となることを保障する基準面１３２と、基準面１３２に接面するエンジンシリンダヘッド２００を支え保つレール１３３と、エンジンシリンダヘッド２００を所定の位置で基準面１３２に接面させるためのクランパー１３４と、クランパー１３４の駆動源であるシリンダ１３５などから構成される。上述したように、治具１１０内に固持されたエンジンシリンダヘッド２００は「吸気側傾斜姿勢」にあるため、かかる治具１１０が設置されたステーションＡ、Ｂ、Ｃは、「軸線２０１」回りの機能孔２０１Ａ、２０１Ｂ、２０１Ｃ（図１６参照）を加工するための場所である。
【００１４】尚、治具１１０内に固持されたエンジンシリンダヘッド２００に対して、工作機械１１２の各工具（図示しない）が届くようにするために、基準面１３２には開口部１３６が設けられている。また、基準面１３２とは反対のクランパー１３４の側にも、明確に図示はさていないが、工作機械１１２の各工具（図示しない）が届くようにするための開口部が設けられている。
【００１５】一方、各ステーションＥ、Ｆ、Ｇに設置された治具１１１（図１８参照）は、エンジンシリンダヘッド２００を「排気側傾斜姿勢」で固持するものであるので、図２０の治具１１０（各ステーションＡ、Ｂ、Ｃに設置されたもの）と比べ、その基準面１３２やクランパー１３４に相当するものの傾斜角度などが異なっている。しかし、その他の概要については、図２０の治具１１０（各ステーションＡ、Ｂ、Ｃに設置されたもの）と同様である。上述したように、治具１１１内に固持されたエンジンシリンダヘッド２００は「排気側傾斜姿勢」にあるため、かかる治具１１１が設置されたステーションＥ、Ｆ、Ｇは、「軸線２０２」回りの機能孔２０２Ａ、２０２Ｂ、２０２Ｃ（図１７参照）を加工するための場所である。
【００１６】次に、加工機械１１２の概要について、図２１と図２２を参照しながら説明する。図２１は、各ステーションＡ、Ｂ、Ｃ、Ｅ、Ｆ、Ｇの両側に設けられた加工機械１１２の概要を示した正面図である。また、図２２は、図２１のＱ－Ｑ線で切断した断面図である。加工機械１１２は、治具１１０に「吸気側傾斜姿勢」で固持されたエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ（図１６参照）、又は、治具１１１に「排気側傾斜姿勢」で固持されたエンジンシリンダヘッド２００の機能孔２０２Ａ、２０２Ｂ、２０２Ｃ（図１７参照）を、加工するものである。
【００１７】また、加工機械１１２は、図２１に示すように、ＸＺ軸送りユニットのテーブル１４４上に、ギヤボックス１４１、モータ１４２などが載置されたものである。そして、ギヤボックス１４１には、スピンドル１４５、変速機構などが内蔵されている。ここでは、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって（図１４参照）、６本のスピンドル１４５がギヤボックス１４１内に並んで納められている。そして、ギヤボックス１４１内に納められた６本のスピンドル１４５については、変速機構や駆動ベルト１４３を介して、２個のモータ１４２によって回転させることができる。よって、かかるスピンドル１４５の軸端に取り付けられた各工具（図示しない）を回転させることが可能となる。さらに、回転する各工具（図示しない）は、テーブル１４４のＸＺ軸送りユニットを介して、ＸＺ軸をもって制御されながら同時に送り出すことができる。これらにより、６本のスピンドル１４５の軸端に取り付けられた各工具（図示しない）による加工が可能となる。
【００１８】尚、各工具（図示しない）については、加工対象となる機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの径の大きさや、加工作業の工程などに応じたものが、各スピンドルの軸端に対し取り付けられる。また、テーブル１４４のＸＺ軸送りユニットをもって制御する際に使用されるＸＺ軸は、エンジンシリンダヘッド２００が搬送されるライン１０１に平行な軸（Ｘ軸）と、それに対して垂直かつ水平な方向にあってギヤボックス１４１内に納められたスピンドル１４５の中心軸に平行な軸（Ｚ軸）とで構成される（図１８参照）。
【００１９】次に、このような概要を持つトランスファマシン１００で、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの加工を行う方法について説明する。先ず、搬入部１０２のローラコンベヤ１０８において、「正立姿勢」のエンジンシリンダヘッド２００が搬入される。そして、ローラコンベヤ１０８上のエンジンシリンダヘッド２００は、図示しないシリンダによって、「正立姿勢」のままで水平に押し出され、姿勢変換装置１０５の保持部１２１に押し入れられる。
【００２０】姿勢変換装置１０５では、エンジンシリンダヘッド２００が保持部１２１に押し入れられると、シリンダ１２３のロッドを引き込ませて、保持部１２１に保持されたエンジンシリンダヘッド２００を「正立姿勢」から「吸気側傾斜姿勢」に変換する。その後、保持部１２１に保持されたエンジンシリンダヘッド２００は、図示しないトランスバーによって、下側から受け止められて「吸気側傾斜姿勢」のままで水平に搬送され、ステーションＡの治具１１０の固持部１３１に送り入れ

られる。
【００２１】ステーションＡの治具１１０では、「吸気側傾斜姿勢」のエンジンシリンダヘッド２００が固持部１３１に送り入れられると、シリンダ１３５のロッドを押し出して、クランパー１３４をエンジンシリンダヘッド２００に押圧させ、エンジンシリンダヘッド２００を基準面１３２に所定の位置で接面させる。そして、図示しないトランスバーを下側へ後退させる。これにより、エンジンシリンダヘッド２００は「吸気側傾斜姿勢」で正確に固定され、エンジンシリンダヘッド２００の「軸線２０１」は、ＸＺ軸で形成される平面上でＺ軸と平行な状態となる。その後、ステーションＡの両側にある工作機械１１２のテーブル１４４のＸＺ軸送りユニットで制御することによって、ギヤボックス１４１内に納められた各スピンドル１４５の軸端にそれぞれ取り付けられた工具（図示しない）を、治具１１０内に固持されたエンジンシリンダヘッド２００の「軸線２０１」上を沿うように送り出す。
【００２２】これにより、治具１１０内に固持されたエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃの加工が可能となる。但し、ステーションＡにおいては、その両側にある工作機械１１２の一方で機能孔２０１Ａの荒加工を行い、他方で機能孔２０１Ｃの荒加工を行っている。そして、工作機械１１２のギヤボックス１４１内に納められた６本のスピンドル１４５は、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって並んでいることから、６本のスピンドル１４５の軸端にそれぞれ取り付けられた各工具（図示しない）は、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって、同時に送り出される。従って、このときは、一方の工作機械１１２における１回の送り出しにより、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のそれぞれにおいて、各機能孔２０１Ａの荒加工が同時に行われる。また、同様にして、他方の工作機械１１２による１回の送り出しにより、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のそれぞれにおいて、各機能孔２０１Ｃの荒加工が同時に行われる。
【００２３】しかし、エンジンシリンダヘッド２００は６気筒４バルブのものであり、１個の「燃焼室」に対して２個の吸気バルブが収装されるものであるから、１個の「燃焼室」においては２本の「軸線２０１」が存在する（図１４参照）。すなわち、上述した加工においては、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のそれぞれにおいて、２本の「軸線２０１」のうち一方の「軸線２０１」を中心に直列的に点在する機能孔２０１Ａ、２０１Ｃについて行われたのみである。
【００２４】そこで、その後においては、さらに、ギヤボックス１４１内に納められたスピンドル１４５の軸端に取り付けられた工具（図示しない）を、工作機械１１２のテーブル１４４のＸＺ軸送りユニットで制御することによって、他方の「軸線２０１」を中心に直列的に点在する機能孔２０１Ａ、２０１Ｃの加工が行われる。従って、ステーションＡにおいては、一方の工作機械１１２における送り出し、すなわち、一方の工作機械１１２による機能孔２０１Ａの荒加工は２回行われる。同様にして、他方の工作機械１１２における送り出し、すなわち、他方の工作機械１１２による機能孔２０１Ｃの荒加工は２回行われる。これにより、ステーションＡにおいては、エンジンシリンダヘッド２００の機能孔２０１Ａと機能孔２０１Ｃの全てについて、荒加工が行われる。
【００２５】このようにして、ステーションＡにおける加工が終了すると、ステーションＡの治具１１０では、シリンダ１３５のロッドを引き込んで、クランパー１３４をエンジンシリンダヘッド２００から引き離し、エンジンシリンダヘッド２００の基準面１３２に対する接面を解除させる。その後、保持部１３１に保持されたエンジンシリンダヘッド２００は、図示しないトランスバーによって、下側から受け止められて「吸気側傾斜姿勢」のままで水平に搬送され、ステーションＢの治具１１０の固持部１３１に送り入れられる。
【００２６】ステーションＢにおいても、上述したステーションＡと同様なことが行われる。但し、その両側にある工作機械１１２の一方で機能孔２０１Ｂの荒加工を行た後に他方で機能孔２０１Ｂの仕上加工を行う点と、かかる加工終了後にエンジンシリンダヘッド２００がステーションＣの治具１１０の固持部１３１に送り入れられる点が異なる。また、ステーションＣにおいても、上述したステーションＡと同様なことが行われる。但し、その両側にある工作機械１１２の一方で機能孔２０１Ａの仕上げ加工を行うとともに他方で機能孔２０１Ｃの仕上加工を行う点と、かかる加工終了後にエンジンシリンダヘッド２００が中間部１０３に送られる点が異なる。以上より、中間部１０３に送られたエンジンシリンダヘッド２００においては、全ての機能孔２０１Ａ、２０１Ｂ、２０１Ｃの加工が行われたことになる。
【００２７】尚、図示しないトランスバーによって、エンジンシリンダヘッド２００を「吸気側傾斜姿勢」のままで水平に行われる搬送は、姿勢変換装置１０５からステーションＡの治具１１０への搬送、ステーションＡの治具１１０からステーションＢの治具１１０への搬送、ステーションＢの治具１１０からステーションＣの治具１１０への搬送、ステーションＣの治具１１０から中間部１０３への搬送のいずれについても、一本のトランスバーによって同時進行的に行われる。
【００２８】次に、中間部１０３に送られたエンジンシリンダヘッド２００は、図示しないシリンダによって、「吸気側姿勢」のままで水平に姿勢変換装置１０６まで押し出される。姿勢変換装置１０６では、エンジンシリ

ンダヘッド２００を、「吸気側姿勢」から「排気側姿勢」に変換する。その後においては、搬入部１０２の姿勢変換装置１０５から中間部１０３までの上述した場合と同様なことが行われる。

【００２９】すなわち、中間部１０３においては、姿勢変換装置１０６の保持部に保持されたエンジンシリンダヘッド２００は、「排気側姿勢」のままで水平にステーションＤの治具１１１の固持部に送り入れられる。また、ステーションＤにおいては、その両側にある工作機械１１２の一方で機能孔２０２Ａの荒加工を行うとともに他方で機能孔２０２Ｃの荒加工を行い、かかる加工終了後は、エンジンシリンダヘッド２００は「排気側姿勢」のままで水平にステーションＥの治具１１１の固持部に送り入れられる。また、ステーションＥにおいては、その両側にある工作機械１１２の一方で機能孔２０２Ｂの荒加工を行た後に他方で機能孔２０２Ｂの仕上加工を行い、かかる加工終了後は、エンジンシリンダヘッド２００は「排気側姿勢」のままで水平にステーションＦの治具１１１の固持部に送り入れられる。また、ステーションＦにおいては、その両側にある工作機械１１２の一方で機能孔２０２Ａの仕上加工を行うとともに他方で機能孔２０２Ｃの仕上加工を行い、かかる加工終了後は、エンジンシリンダヘッド２００は「排気側姿勢」のままで水平に搬出部１０４の姿勢変換装置１０７の保持部に送り入れられる。

【００３０】以上より、搬出部１０４に送られたエンジンシリンダヘッド２００においては、全ての機能孔２０２Ａ、２０２Ｂ、２０２Ｃの加工が行われたことになり、もって、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの全ての加工が完了したことになる。その後は、搬出部１０４の姿勢変換装置１０７の保持部に保持されたエンジンシリンダヘッド２００は、「排気側姿勢」から「正立姿勢」に変換され、図示しないシリンダによって、「正立姿勢」のままで水平にローラコンベヤ１０９上に押し出される。そして、ローラコンベヤ１０９によって、トランスファマシン１００の外部に搬出される。

【００３１】尚、上述したように、図１４に示す６気筒４バルブのエンジンシリンダヘッド２００においては、６個の「燃焼室」のそれぞれに２本の「軸線２０１」が存在していることから、１個のエンジンシリンダヘッド２００に合計１２本の「軸線２０１」が存在することになる。従って、エンジンシリンダヘッド２００が「吸気側姿勢」にあるときは、１２本の全ての「軸線２０１」がＸＺ軸で形成される平面上でＺ軸と平行な状態となる。そこで、各工作機械１１２のギヤボックス１４１内に１２本のスピンドル１４５を備えれば、例えば、ステーションＡにおいては、一方の工作機械１１２による機能孔２０１Ａの荒加工と他方の工作機械１１２による機能孔２０１Ｃの荒加工をそれぞれ１回の送り出しで終わらせることが可能となり、それらの加工を各２回の送り出しで行う上述した従来技術のものと比べ、大量生産性がさらに高まるとも考えられる。しかし、１個のエンジンシリンダヘッド２００における１２本の「軸線２０１」の各間隔は狭く、１２本の「軸線２０１」に合わせて１２本のスピンドル１４５をギヤボックス１４１に並べることはスペース的に困難である。このことは、「軸線２０２」についても言うことができる。

【００３２】すなわち、各工作機械１１２のギヤボックス１４１内の６本のスピンドル１４５を、１個のエンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって並べ、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、両側の工作機械１１２による加工をそれぞれ２回の送り出しで行う、上述したトランスファマシン１００は、６気筒４バルブのエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの加工にとって、大量生産性を最大限に追求したトランスファ方式の生産システムであると言うことができる。

【００３３】

【発明が解決しようとする課題】しかしながら、上述したトランスファマシン１００は、その製作後に、最大生産能力の増強又は削減することが困難なものであった。従って、かかる最大生産能力は、トランスファ方式の生産システムの利点である大量生産性を発揮させるために、予想される最大生産量に十分に対応できるように設計されるのが通常であった。そして、将来起こるとする生産量の増減に対しては、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆに搬送されるエンジンシリンダヘッド２００のサイクルタイムの調整により対応しており、当初に設定された最大生産能力の範囲内において行われていた。

【００３４】従って、生産量が予想した程に伸びず、エンジンシリンダヘッド２００のサイクルタイムの調整を行った期間が、トランスファ方式の生産システムの利点である大量生産性が有効に発揮できない程度に長くなると、逆に、かかる大量生産性という利点が過剰能力という欠点へと転化し、設備投資の収益性が非常に悪くなるおそれがあった。特に、自動車などのエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃを加工対象とするトランスファマシン１００においては、自動車などの受注量が予想された程に伸びないケースや、自動車などのモデルチェンジの際に異なる種類のエンジンシリンダヘッド２００に切り替えられるケース等により、エンジンシリンダヘッド２００の生産量が予想を下回ることは多々あることなので、その危険性は大きいと言える。

【００３５】また、エンジンシリンダヘッド２００から異なる種類のエンジンシリンダヘッド２００への切替えに対しては、エンジンシリンダヘッド２００の「燃焼室」のピッチ間隔、「軸線２０１」や「軸線２０２」の

傾斜角度、外形などが相違することにより、原則として、各工作機械１１２のスピンドル１４５のピッチ間隔、各治具１１０、１１１の基準面１３２の傾斜角度やクランパー１３４の位置などは変更しなければならなくなる。しかしながら、各工作機械１１２のスピンドル１４５のピッチ間隔、各治具１１０、１１１の基準面１３２の傾斜角度やクランパー１３４の位置については、それらを調整することは構造的にできないものであるから、エンジンシリンダヘッド２００から異なる種類のエンジンシリンダヘッド２００への切替えに対応するには、全ての工作機械１１２と全ての治具１１０、１１１を大幅に改造しなければならず、追加投資が過大となって、設備投資の収益性が非常に悪くなるおそれがあった。特に、自動車などのエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃを加工対象とするトランスファマシン１００においては、自動車などのモデルチェンジの際に異なる種類のエンジンシリンダヘッド２００に切り替えられるケース等により、エンジンシリンダヘッド２００から異なる種類のエンジンシリンダヘッド２００に切り替わること（以下、単に「エンジンシリンダヘッド２００の切替」という）は多々あることなので、その危険性は大きいと言える。

【００３６】そこで、本発明は、上述した問題点を解決するためになされたものであり、工作物であるエンジンシリンダヘッドの生産量の変動に対して、又は、工作物である「エンジンシリンダヘッドの切替」に対して、低コストで対応することができるトランスファマシンを提供することを目的とする。

【００３７】

【課題を解決するための手段】この目的を達成するために成された請求項１に係るトランスファマシンは、各ステーション上にエンジンシリンダヘッドが固定された際に、各ステーション横に並べられた複数のスピンドルの軸端にそれぞれ取り付けられた各工具を回転させながらＸＺ軸送りユニットで同時に送り出すことによって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで多数の機能孔を同時に加工するとともに、１個のエンジンシリンダヘッドを各ステーションへ順次に搬送することによって、１個のエンジンシリンダヘッドの機能孔に対する加工作業を各工程順に行うトランスファマシンであって、１本のスピンドルのみを納めた単軸の主軸頭を前記ＸＺ軸送りユニット上に並べて各工具を同時に送り出すとともに、各主軸頭内の１本のスピンドルを１個のモータとカップリングで連結させて各工具を回転させることによって、前記ＸＺ軸送りユニット上に並べられる主軸頭の増減を自在とし、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の数を変更できることを特徴とする。

【００３８】また、請求項２に係るトランスファマシンは、請求項１に記載するトランスファマシンであって、前記主軸頭が並列的に固定されるハウジングを前記ＸＺ軸送りユニット上に取り付けることによって、前記ＸＺ軸送りユニット上に並べられる主軸頭のピッチ間隔を確保し、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔のピッチ間隔を保障したことを特徴とする。

【００３９】また、請求項３に係るトランスファマシンは、請求項２に記載するトランスファマシンであって、前記ハウジングを前記ハウジングと互換性のある他のハウジングに取り替えることによって、前記ＸＺ軸送りユニット上に並べられる主軸頭のピッチ間隔の設定を自在とし、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔のピッチ間隔を変更できることを特徴とする。

【００４０】また、請求項４に係るトランスファマシンは、各ステーション上にエンジンシリンダヘッドが傾斜姿勢で固定された際に、各ステーション横に並べられた複数のスピンドルの軸端にそれぞれ取り付けられた各工具を回転させながらＸＺ軸送りユニットで同時に送り出すことによって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで多数の機能孔を同時に加工するとともに、１個のエンジンシリンダヘッドを各ステーションへ順次に搬送することによって、１個のエンジンシリンダヘッドの機能孔に対する加工作業を各工程順に行うトランスファマシンであって、各ステーション上に設置される治具で前記エンジンシリンダヘッドを固持しながら前記エンジンシリンダヘッドの傾斜姿勢を制御することによって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の傾斜角度を変更できることを特徴とする。

【００４１】また、請求項５に係るトランスファマシンは、請求項４に記載するトランスファマシンであって、前記エンジンシリンダヘッドの位置決めを確保するためのロケートピンが設けられたロケート部材を前記治具に取り付け、前記ロケート部材を前記ロケート部材と互換性のある他のロケート部材に取り替えることによって、前記ロケートピンの配設状態を変更できることを特徴とする。

【００４２】また、請求項６に係るトランスファマシンは、請請求項４又は請求項５に記載するトランスファマシンであって、前記エンジンシリンダヘッドを固持するためのクランプピンが設けられたクランプ部材を前記治具に取り付け、前記クランプ部材を前記クランプ部材と互換性のある他のクランプ部材に取り替えることによって、前記クランプピンの配設状態を変更できることを特徴とする。

【００４３】このような構成を有する本発明のトランス

ファマシンでは、各ステーション横のＸＺ軸送りユニット上に並べられた各主軸頭の単軸（スピンドル）のそれぞれが、１個のモータとカップリングで連結されている。そして、各ステーション上において、工作物であるエンジンシリンダヘッドが固定された際には、各モータで各主軸頭の単軸（スピンドル）を回転させることにより、各主軸頭の単軸（スピンドル）の軸端にそれぞれ取り付けられた各工具を回転させることができる。さらに、各主軸頭の単軸（スピンドル）の軸端にそれぞれ取り付けられた各工具を、ＸＺ軸送りユニットにより同時に送り出させることができる。これにより、各ステーションにおいて、１回の送り出しで、１個のエンジンシリンダヘッドに対し多数の機能孔を同時に加工することができる。

【００４４】このとき、主軸頭の単軸（スピンドル）と１個のモータのカップリングによる連結は、従来技術の欄で説明したベルト連結とは異なり、その構造は単調で他の主軸頭や他のモータからは独立して行うことができるものであることから、ＸＺ軸送りユニット上に並べられる各主軸頭の数を増やしたり減らしたりすることを、大改造することなく簡単に行うことができる。そして、増減の対象となった主軸頭やモータやカップリングなどは、他のトランスファマシンとの間で調達・流用することができる。これにより、トランスファマシンの製作後においても、ＸＺ軸送りユニット上に並べられる主軸頭の増減が自在となり、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の数を変更することができる。

【００４５】すなわち、ＸＺ軸送りユニット上に並べられる主軸頭の数を増加させれば、ＸＺ軸送りユニットで同時に送り出される工具の数を増加させることができるので、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の数も増加する。

【００４６】よって、例えば、あるステーションにおいて、１個のエンジンシリンダヘッドに対し１２個の機能孔を加工しなければならない場合に、当該ステーション横のＸＺ軸送りユニット上に並べられる主軸頭の数が２個のときには、当該ＸＺ軸送りユニットで同時に送り出される工具の数も２個なので、１個のエンジンシリンダヘッドに対し１２個の機能孔を加工するためには、当該ＸＺ軸送りユニットによる各工具の同時送り出しを６回行う必要がある。しかしながら、当該ステーション横のＸＺ軸送りユニット上に並べられる主軸頭の数を１個増やした３個のときには、当該ＸＺ軸送りユニットで同時に送り出される工具の数も３個に増えるので、１個のエンジンシリンダヘッドに対し１２個の機能孔を加工するためには、当該ＸＺ軸送りユニットによる各工具の同時送り出しは４回行うだけでよい。さらに、当該ステーション横のＸＺ軸送りユニット上に並べられる主軸頭の数を３個増やした６個のときには、当該ＸＺ軸送りユニットで同時に送り出される工具の数も６個に増えるので、１個のエンジンシリンダヘッドに対し１２個の機能孔を加工するためには、当該ＸＺ軸送りユニットによる各工具の同時送り出しは２回行うだけでよい。

【００４７】このようにして、ＸＺ軸送りユニット上に並べられる主軸頭の数を増加させれば、ＸＺ軸送りユニットによる各工具の同時送り出し回数を減少させることができ、各ステーションにおける加工に必要な時間は短縮されるので、トランスファマシンの最大生産能力を向上させることができる。よって、トランスファマシンが製作された後でも、ＸＺ軸送りユニット上に並べられる主軸頭の数を増加させることにより、トランスファマシンの最大生産能力を増強させることができる。これにより、トランスファマシンの最大生産能力を、予想される最大生産量に十分に対応できるようにする必要はなくなり、当初の最大生産能力を予想される通常の生産量に対応できるものとし、予想される最大生産量が現実のものとなったときに、当初の最大生産能力を増強させることが可能となる。

【００４８】逆に、ＸＺ軸送りユニット上に並べられる主軸頭の数を減少させれば、ＸＺ軸送りユニットで同時に送り出される工具の数を減少させることができるので、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の数も減少する。よって、トランスファマシンが製作された後でも、ＸＺ軸送りユニット上に並べられる主軸頭の数を減少させることにより、トランスファマシンの最大生産能力を削減させることができる。尚、ここでは、ＸＺ軸送りユニット上に並べられる主軸頭の数が１個になることも含む。

【００４９】以上より、当初の最大生産能力を低く抑えることができるので、イニシャルコストの低減に貢献することができる。また、その後、最大生産能力を増強させる場合には、他のトランスファマシンで不要となった主軸頭やモータやカップリングなどを流用することができる一方、生産量を減少させる場合には、各ステーションに搬送されるエンジンシリンダヘッドのピッチタイムを大きくすることによって対応するだけでなく、最大生産能力を削減させることによっても対応することができる。そして、最大生産能力を削減させるときには、不要となった主軸頭やモータやカップリングなどを他のトランスファマシンに流用させることができる。従って、最大生産能力の増強・削減の際に新たな設備投資は殆どかからない。

【００５０】さらに、当該トランスファマシン内において、または、他のトランスファマシンとの間において、調達・流用される主軸頭やモータやカップリングなどは共通したものを使用するので、設計費用が安価となる。また、カップリングによる連結構造は単調で構成部品点

数も少ないので、製作費用が安価となる。これらの観点からも、イニシャルコストの低減に貢献することができる。

【００５１】また、ＸＺ軸送りユニット上に主軸頭の単軸（スピンドル）を並べる際には、ＸＺ軸送りユニット上に取り付けられるハウジングを介して行われる。かかるハウジングには、各主軸頭が並列的に固定される場所が予め所定のピッチ間隔で設けられてあり、ＸＺ軸送りユニット上に並べられる主軸頭の増減を自在に行うことをさらに容易にしている。これにより、ＸＺ軸送りユニット上に並べられる主軸頭のピッチ間隔は確保され、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔のピッチ間隔の保障がなされる。

【００５２】従って、ＸＺ軸送りユニット上に取り付けられるハウジングを、ピッチ間隔の値が異なる他のハウジングに取り替えることにより、ＸＺ軸送りユニット上に並べられる主軸頭のピッチ間隔の設定を自在にすることができ、もって、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔のピッチ間隔を変更することが可能となる。

【００５３】特に、エンジンシリンダヘッドの機能孔は、エンジンの多気筒化により、等間隔に複数設けられるのが通常であり、かかるピッチ間隔は、エンジンシリンダヘッドの種類により相違することが多いので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替わる場合には、主軸頭の単軸（スピンドル）のピッチ間隔の変更を必要とすることが多い。そして、このとき、主軸頭の単軸（スピンドル）のピッチ間隔の変更は、大幅に改造することなく単にハウジングを取り替えるだけでできるので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替えられても、過大な追加投資が必要となることはない。

【００５４】また、各ステーション上に設置される治具は、エンジンシリンダヘッドを固持しながらその傾斜姿勢を自由に制御することができる。従って、各ステーションにおいて１個のエンジンシリンダヘッドに対し１回の送り出しで同時に加工される機能孔の傾斜角度を変更することができる。

【００５５】特に、エンジンシリンダヘッドの機能孔は、その機能を確保するため、傾斜して設けられるものが多く、かかる傾斜角度は、エンジンシリンダヘッドの種類により相違することが通常であるので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替わる場合には、エンジンシリンダヘッドの傾斜姿勢の変更を必要とすることが多い。そして、このとき、エンジンシリンダヘッドの傾斜姿勢の変更は、治具を大幅に改造することなく単に治具による制御だけでできるので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替えられても、過大な追加投資が必要となることはない。

【００５６】また、エンジンシリンダヘッドの傾斜角度は、異なる種類のエンジンシリンダヘッド間だけでなく、１個のエンジンシリンダヘッド内でも相違することが多いので、同じエンジンシリンダヘッドであっても、加工対象の機能孔が異なる場合には、エンジンシリンダヘッドの傾斜姿勢の変更を必要とすることが多い。そして、このとき、エンジンシリンダヘッドの傾斜姿勢の変更は、異なる傾斜姿勢ごとに専用の治具を設けるのではなく、各ステーションにおいて共通の治具による制御だけでできるので、治具の共通化により設計費用が安価となり、イニシャルコストの低減に貢献することができる。

【００５７】また、各ステーション上に設置される治具では、エンジンシリンダヘッドを固持する際に、ロケート部材に設けられたロケートピンで、エンジンシリンダヘッドの位置決めを確保している。そして、かかるロケート部材においては、エンジンシリンダヘッドに設けられたロケート孔に対応するように、ロケートピンの位置や長さなどの配設状態が決定されている。従って、治具に取り付けられるロケート部材を、ロケートピンの配設状態が異なる他のロケート部材に取り替えることによって、ロケートピンの配設状態を変更することができる。

【００５８】特に、エンジンシリンダヘッドの表面形状は、エンジンシリンダヘッドの種類により相違することが多いので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替わる場合には、エンジンシリンダヘッドに設けられるロケート孔の位置などは変更を余儀なくされることが多く、ロケートピンの配設状態の変更を必要とすることも多い。そして、このとき、ロケートピンの配設状態の変更は、治具を大幅に改造することなく単にロケート部材を取り替えるだけでできるので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替えられても、過大な追加投資が必要となることはない。

【００５９】また、各ステーション上に設置される治具では、エンジンシリンダヘッドを固持する際に、クランプ材に設けられたクランプピンで、エンジンシリンダヘッドを固持している。そして、かかるクランプ部材においては、エンジンシリンダヘッドに圧接される箇所を考慮して、クランプピンの位置や長さなどの配設状態が決定されている。従って、治具に取り付けられるクランプ部材を、クランプピンの配設状態が異なる他のクランプ部材に取り替えることによって、クランプピンの配設状態を変更することができる。

【００６０】特に、エンジンシリンダヘッドの表面形状は、エンジンシリンダヘッドの種類により相違することが多いので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替わる場合には、エンジン

シリンダヘッドに圧接される箇所などは変更を余儀なくされることが多く、クランプピンの配設状態の変更を必要とすることも多い。そして、このとき、クランプピンの配設状態の変更は、治具を大幅に改造することなく単にクランプ部材を取り替えるだけでできるので、エンジンシリンダヘッドが異なる種類のエンジンシリンダヘッドに切り替えられても、過大な追加投資が必要となることはない。

【００６１】すなわち、本発明のトランスファマシンでは、ＸＺ軸送りユニット上に並べられる主軸頭の増減を自在にしたことから、その製作後に最大生産能力の増強・削減が可能となり、当初の最大生産能力を低く抑えることができるので、イニシャルコストの低減に貢献することができ、また、主軸頭やモータやカップリングなどは流用することができることから、設計費用が安価で済むとともに、最大生産能力の増強・削減の際に新たな設備投資は殆どかかることがなく、さらに、主軸頭やモータの連結構造は単調なものであるから、その製作費用も安価で済ませることができるので、工作物であるエンジンシリンダヘッドの生産量の変動に対して、低コストで対応することができる。

【００６２】また、ハウジングの取り替え、治具による制御、ロケート部材の取り替え、クランプ部材の取り替えによって、エンジンシリンダヘッドの機能孔のピッチ間隔の変更、エンジンシリンダヘッドの機能孔の傾斜角度の変更、エンジンシリンダヘッドのロケート孔の位置の変更、エンジンシリンダヘッドに対するクランプピンの圧接箇所の変更に対応することができ、その際に、過大な追加投資が必要となることはないので、工作物である「エンジンシリンダヘッドの切替」に対して、低コストで対応することができる。

【００６３】また、各ステーション上に設置される治具においては、エンジンシリンダヘッドの傾斜姿勢を自由に制御することができることから、治具による固持が解除される際のエンジンシリンダヘッドの姿勢を全ステーションにおいて共通化させることが可能となり、これにより、各ステーションに対する搬送時や搬出時のエンジンシリンダヘッドの姿勢も共通化させることができるので、従来技術の欄で述べた３個の姿勢切り替え装置のうち一部又は全部をなくすことが可能となり、この観点からも、イニシャルコストを低く抑えることができる。

【００６４】また、主軸頭の増減、ハウジングの取り替え、ロケート部材の取り替え、クランプ部材の取り替えに要する時間は、従来技術の大幅な改造に要する時間と比べて、格段に短いので、長期間にわたる生産のシャットダウンを防止することができ、この観点からも、設備投資の収益性を高くすることができる。

【００６５】

【発明の実施の形態】以下、本発明の実施の形態を図面を参照にして説明する。本実施の形態のトランスファマシンは、従来技術の欄で説明したトランスファマシン１００と同じく、図１４のエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの加工をトランスファ方式の生産システムで行うものである。

【００６６】図１に、本実施の形態のトランスファマシン１を平面図で示す。本実施の形態のトランスファマシン１は、従来技術の欄で説明したトランスファマシン１００との差を明らかにするため、図１８に示した従来技術のトランスファマシン１００のレイアウトを基本にしており、共通するものについては、従来技術の欄で使用した同じ符号を用いている。

【００６７】すなわち、本実施の形態のトランスファマシン１では、エンジンシリンダヘッド２００が搬送されるライン１０１上に、搬入部１０２、搬出部１０４が設けられている。そして、搬入部１０２には、搬入用のローラコンベヤ１０８と姿勢変換装置１５などが設けられいる。また、搬出部１０４には、姿勢変換装置１７と搬出用のローラコンベヤ１０９などが設けられている。

【００６８】さらに、搬入部１０２と搬出部１０４との間には６つのステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆが設けられるとともに、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上には治具１０が設置されている。そして、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆの両側には加工機械１２が設けられいる。

【００６９】ここで、上述した姿勢変換装置１５、１７、治具１０、加工機械１２の概要について説明する。

【００７０】先ず、姿勢変換装置１５、１７の概要について説明する。姿勢変換装置１５は、従来技術の欄で説明した姿勢変換装置１０５と比較すると、「正立姿勢」で保持されたエンジンシリンダヘッド２００を、図１３に示された姿勢（以下、「横立姿勢」という）に変換する点が異なるものの、その概要については、従来技術の欄で説明した姿勢変換装置１０５と同様である。また、姿勢変換装置１７は、従来技術の欄で説明した姿勢変換装置１０７と比較すると、図１３に示された「横立姿勢」で保持されたエンジンシリンダヘッド２００を、「正立姿勢」に変換する点が異なるものの、その概要については、従来技術の欄で説明した姿勢変換装置１０７と同様である。

【００７１】すなわち、姿勢変換装置１５、１７の両者は、エンジンシリンダヘッド２００の姿勢を「正立姿勢」と「横立姿勢」との間で変換する点については共通していることから、その構造は全く同じものであり、搬入部１０２と搬出部１０４において、向かい合わせるように設置される。かかる観点からすれば、姿勢変換装置１５、１７の両者は、共通化されて設計費用が安価となり、イニシャルコストの低減に貢献するものと言うことができる。

【００７２】次に、治具１０の概要について、図２～図

９を参照しながら説明する。図２は、治具１０の正面図である。また、図３は、治具１０の背面図である。また、図４は、治具１０の本体２５の基準面３２を示した平面図である。また、図５と図６は、治具１０のロケート部材４９の駆動系の概要を示した断面図である。また、図７は、治具１０の側面図である。

【００７３】また、治具１０に対する理解を容易にするために、治具１０を正面側から見た斜視図を図８に示すとともに、治具１０を背面側から見た斜視図を図９に示す。但し、図８と図９に示された治具１０は、図１４の６気筒４バルブのエンジンシリンダヘッド２００に対するものでなく、図示しない４気筒４バルブのエンジンシリンダヘッドに対する別のものである。従って、図２から図７に示された治具１０と、図８と図９に示された治具１０との間では、互いに相当する部品の形状が異なっていたり、相当する部品が存在しないことなどがある。尚、ここでは、治具１０に対する理解を容易にする観点から、互いに相当する部品については同じ符号を用いている。

【００７４】そして、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆに設置される治具１０は、例えば、図７に示すように、エンジンシリンダヘッド２００を固持する固持部３１を有している。かかる固持部３１は、エンジンシリンダ２００が「横立姿勢」で送り入れられるとともに送り出されるものであって、エンジンシリンダヘッド２００の一部が接面する基準面３２と、基準面３２に接面するエンジンシリンダヘッド２００を支え保つ棒形のレール３３と、エンジンシリンダヘッド２００を基準面３２に接面させるためのクランプ部材であるクランパー３４と、クランパー３４の駆動源であるシリンダ３５などから構成される。

【００７５】尚、治具１０内に固持されたエンジンシリンダヘッド２００に対して、工作機械１２の各工具（図示しない）が届くようにするために、例えば、図３に示すように、基準面３２には開口部３７が設けられている。また、基準面３２とは反対のクランパー３４の側にも、例えば、図２に示すように、工作機械１２の各工具（図示しない）が届くようにするための開口部３６が設けられている。また、クランパー３４の側には、例えば、図７に示すように、基準面３２とは反対側のエンジンシリンダヘッド２００と当接する棒形の２本のレール２２と、エンジンシリンダヘッド２００を支え保つ棒形のレール２３が設けられている。但し、図８と図９の治具１０においては、基準面３２の側で、基準面３２の側のエンジンシリンダヘッド２００と当接する棒形のレール２４が設けられている。また、エンジンシリンダヘッド２００を支え保つレール２３、３３は、棒形の形状ではない。

【００７６】そして、例えば、図２に示すように、上述した保持部３１などを有する本体２５は、その両側を架台２７に設けられたベアリング２６で軸支されている。また、架台２７の上方には、ボールネジ２８をサーボモータ２９で押し出したり引き込ませたりする駆動シリンダ３０が、軸支部４１を介して回動可能に支えられている。さらに、駆動シリンダ３０のボールネジ２８の先端４２は、本体２５の側面と回動可能に接続されている。

【００７７】従って、図７に示すように、駆動シリンダ３０において、サーボモータ２９でボールネジ２８を引き込ませると、本体２５は時計方向に回動して傾く。そして、本体２５を、その一部が二点鎖線で示された本体４６にまで傾けることにより、「横立姿勢」のエンジンシリンダ２００を「吸気側傾斜姿勢」にすることができる。尚、このときの駆動シリンダ３０は、軸支部４１を中心にして時計方向に回動し、その中心線４３が中心線４４にまで傾く。また、その逆に、サーボモータ２９でボールネジ２８を押し出させると、本体２５は反時計方向に回動して傾く。そして、本体２５を、その一部が二点鎖線で示された本体４７にまで傾けることにより、「横立姿勢」のエンジンシリンダ２００を「排気側傾斜姿勢」にすることができる。尚、このときの駆動シリンダ３０は、軸支部４１を中心にして反時計方向に回動し、その中心線４３が中心線４５にまで傾く。

【００７８】また、例えば、図４に示すように、本体２５の基準面３２の側には、６個の吹出口４８が設けられている。これらの吹出口４８からは、洗浄用のクーラント液や圧縮空気が吹き出される。尚、洗浄用のクーラント液は、エンジンシリンダヘッド２００に付着する切屑などを除去して、エンジンシリンダヘッド２００を基準面３２に確実に接面させるために使用している。また、圧縮空気は、吹出口４８からの漏れ具合により、基準面３２に対するエンジンシリンダヘッド２００の接面の程度を判定するのに使用している。

【００７９】また、例えば、図４に示すように、本体２５の内両側には、ロケートピン５０を有したロケート部材４９が設けられている。そして、図４のＲ－Ｒ線で切断した部分断面図である図５と図６に示すように、ロケート部材４９は、２本の軸ピン５２に案内されながら、シリンダ５１により、押し出され（図５参照）、または、引き込まれる（図６参照）。これにより、ロケート部材４９のロケートピン５０を、保持部３１のエンジンシリンダ２００のロケート孔（図示しない）へ挿脱させることができる。尚、図８と図９の治具１０においては、異なる形状のロケート部材４９を使用しており、かかるロケート部材４９のロケートピン５０も異なる配置（位置や長さなど）にある。

【００８０】次に、加工機械１２の概要について、図１０、図１１、図１２を参照しながら説明する。図１０は、各ステーションＡ、Ｂ、Ｃ、Ｅ、Ｆ、Ｇの両側に設けられた加工機械１２の概要をＺ軸から示した正面図である。また、図１１は、各ステーションＡ、Ｂ、Ｃ、

Ｅ、Ｆ、Ｇの両側に設けられた加工機械１２の概要をＸ軸から示した正面図である。さらに、図１２は、図１０のＳ－Ｓ線でハウジング６２のみを切断した部分断面図である。加工機械１２は、治具１０に「吸気側傾斜姿勢」で固持されたエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、又は、治具１１に「排気側傾斜姿勢」で固持されたエンジンシリンダヘッド２００の機能孔２０２Ａ、２０２Ｂ、２０２Ｃを、加工するものである。

【００８１】また、加工機械１２では、図１０と図１１に示すように、ＸＺ軸送りユニット６１上に取り付けられたハウジング６２において、主軸頭６３とモータ６４が固定されている。かかるハウジング６２においては、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって（図１４参照）、２個の主軸頭６３と２個のモータ６４が固定されている。また、主軸頭６３の内部には、１本のスピンドル６６（図１２参照）が納められている。さらに、図１２に示すように、ハウジング６２内では、主軸頭６３のスピンドル６６がモータ６４とカップリング６５で連結されている。

【００８２】従って、主軸頭６３内に納められた１本のスピンドル６６については、カップリング６５を介して、１個のモータ６４によって回転させることができる。よって、かかるスピンドル６６の軸端に取り付けられる各工具（図示しない）を回転させることが可能となる。さらに、回転する各工具（図示しない）は、ＸＺ軸送りユニット６１を介して、ＸＺ軸をもって制御されながら同時に送り出すことができる。これらにより、スピンドル６６の軸端に取り付けられた各工具（図示しない）による加工が可能となる。尚、各工具（図示しない）については、加工対象となる機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの径の大きさや、加工作業の工程などに応じたものが、各スピンドル６６の軸端に対し取り付けられる。

【００８３】次に、このような概要を持つトランスファマシン１で、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの加工を行う方法について説明する。先ず、搬入部１０２のローラコンベヤ１０８において、「正立姿勢」のエンジンシリンダヘッド２００が搬入される。そして、ローラコンベヤ１０８上のエンジンシリンダヘッド２００は、図示しないシリンダによって、「正立姿勢」のままで水平に押し出され、姿勢変換装置１５の保持部に押し入れられる。

【００８４】姿勢変換装置１５では、エンジンシリンダヘッド２００が保持部に押し入れられると、従来技術の欄で説明した姿勢変換装置１０５と同様なメカニズムで、保持部に保持されたエンジンシリンダヘッド２００を「正立姿勢」から「横立姿勢」に変換する。その後、保持部に保持されたエンジンシリンダヘッド２００は、図示しないトランスバーによって、下側から受け止められて「横立姿勢」のままで水平に搬送され、ステーションＡの治具１０の固持部３１に送り入れられる。

【００８５】ステーションＡの治具１０では、「横立姿勢」のエンジンシリンダヘッド２００が固持部３１に送り入れられると、シリンダ３５のロッドを押し出して、クランパー３４のクランプピン２１をエンジンシリンダヘッド２００に押圧させ、エンジンシリンダヘッド２００の一部を基準面３２に接面させる。同時に、シリンダ５１のロッドを押し出して、ロケート部材４９のロケートピン５０をエンジンシリンダヘッド２００のロケート孔（図示しない）に差込ませ、エンジンシリンダヘッド２００を所定の位置で基準面３２に接面させる。そして、図示しないトランスバーを下側へ後退させる。これにより、エンジンシリンダヘッド２００は「横立姿勢」で正確に固定される。

【００８６】さらに、駆動シリンダ３０において、サーボモータ２９でボールネジ２８を引き込ませることにより、「横立姿勢」のエンジンシリンダ２００を「吸気側傾斜姿勢」にする。これにより、エンジンシリンダヘッド２００は「吸気側傾斜姿勢」で正確に固定され、エンジンシリンダヘッド２００の「軸線２０１」は、ＸＺ軸で形成される平面上でＺ軸と平行な状態となる。その後、ステーションＡの両側にある工作機械１２のＸＺ軸送りユニット６１で制御することによって、主軸頭６３内に納められたスピンドル６６の軸端に取り付けられた工具（図示しない）を、治具１０内に固持されたエンジンシリンダヘッド２００の「軸線２０１」上を沿うように送り出す。

【００８７】これにより、治具１０内に固持されたエンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃの加工が可能となる。但し、ステーションＡにおいては、その両側にある工作機械１２の一方で機能孔２０１Ａの荒加工を行い、他方で機能孔２０１Ｃの荒加工を行っている。そして、工作機械１２のハウジング６２には２個の主軸頭６３が固定され、これらの主軸頭６３内にそれぞれ納められた２本のスピンドル６６は、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって並んでいることから、２本のスピンドル６６の軸端にそれぞれ取り付けられた各工具（図示しない）は、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって、同時に送り出される。従って、このときは、一方の工作機械１２における１回の送り出しにより、エンジンシリンダヘッド２００に設けられた２個の「燃焼室」のそれぞれにおいて、各機能孔２０１Ａの荒加工が同時に行われる。また、同様にして、他方の工作機械１２による１回の送り出しにより、エンジンシリンダヘッド２００に設けられた２個の「燃焼室」のそれぞれにおいて、各機能孔２０１Ｃの荒加工が同時に行われる。

【００８８】しかし、エンジンシリンダヘッド２００は６気筒４バルブのものであり、１個の「燃焼室」に対して２個の吸気バルブが収装されるものであるから、１個の「燃焼室」においては２本の「軸線２０１」が存在する（図１４参照）。すなわち、６個の「燃焼室」を有する１個のエンジンシリンダヘッド２００においては、１２本の「軸線２０１」が存在することになる。一方、上述した加工においては、１個のエンジンシリンダヘッド２００において、１２本の「軸線２０１」のうち２本の「軸線２０１」を中心に直列的に点在する機能孔２０１Ａ、２０１Ｃについて行われたのみである。

【００８９】そこで、その後においては、さらに、主軸頭６３内に納められたスピンドル６６の軸端に取り付けられた工具（図示しない）を、工作機械１２のＸＺ軸送りユニット６１で制御することによって、残りの「軸線２０１」を中心に直列的に点在する機能孔２０１Ａ、２０１Ｃの加工が行われる。従って、ステーションＡにおいては、一方の工作機械１２における送り出し、すなわち、一方の工作機械１１２による機能孔２０１Ａの荒加工は６回行われる。同様にして、他方の工作機械１２における送り出し、すなわち、他方の工作機械１２による機能孔２０１Ｃの荒加工は６回行われる。これにより、ステーションＡにおいては、エンジンシリンダヘッド２００の機能孔２０１Ａと機能孔２０１Ｃの全てについて、荒加工が行われる。

【００９０】このようにして、ステーションＡにおける加工が終了すると、ステーションＡの治具１０では、駆動シリンダ３０において、サーボモータ２９でボールネジ２８を押し出させることにより、「吸気側傾斜姿勢」のエンジンシリンダ２００を「横立姿勢」に戻す。そして、シリンダ３５のロッドを引き込んで、クランパー３４のクランプピン２１をエンジンシリンダヘッド２００から引き離す。同時に、シリンダ５１のロッドを引き込んで、ロケート部材４９のロケートピン５０をエンジンシリンダヘッド２００のロケート孔（図示しない）から外す。これにより、エンジンシリンダヘッド２００の基準面３２に対する接面を解除させることができる。その後、保持部３１に保持されたエンジンシリンダヘッド２００は、図示しないトランスバーによって、下側から受け止められて「横立姿勢」のままで水平に搬送され、ステーションＢの治具１０の固持部３１に送り入れられる。

【００９１】ステーションＢにおいても、上述したステーションＡと同様なことが行われる。但し、その両側にある工作機械１２の一方で機能孔２０１Ｂの荒加工を行った後に他方で機能孔２０１Ｂの仕上加工を行う点と、かかる加工終了後にエンジンシリンダヘッド２００がステーションＣの治具１０の固持部３１に送り入れられる点が異なる。また、ステーションＣにおいても、上述したステーションＡと同様なことが行われる。但し、その両側にある工作機械１２の一方で機能孔２０１Ａの仕上げ加工を行うとともに他方で機能孔２０１Ｃの仕上加工を行う点と、かかる加工終了後にエンジンシリンダヘッド２００がステーションＤの治具１０の固持部３１に送られる点が異なる。以上より、ステーションＤの治具１０の固持部３１に送られたエンジンシリンダヘッド２００においては、全ての機能孔２０１Ａ、２０１Ｂ、２０１Ｃの加工が行われたことになる。

【００９２】次に、ステーションＤの治具１０では、「横立姿勢」のエンジンシリンダヘッド２００が固持部３１に送り入れられると、シリンダ３５のロッドを押し出して、クランパー３４のクランプピン２１をエンジンシリンダヘッド２００に押圧させ、エンジンシリンダヘッド２００の一部を基準面３２に接面させる。同時に、シリンダ５１のロッドを押し出して、ロケート部材４９のロケートピン５０をエンジンシリンダヘッド２００のロケート孔（図示しない）に差込ませ、エンジンシリンダヘッド２００を所定の位置で基準面３２に接面させる。そして、図示しないトランスバーを下側へ後退させる。これにより、エンジンシリンダヘッド２００は「横立姿勢」で正確に固定される。

【００９３】さらに、駆動シリンダ３０において、サーボモータ２９でボールネジ２８を押し出させることにより、「横立姿勢」のエンジンシリンダ２００を「排気側傾斜姿勢」にする。これにより、エンジンシリンダヘッド２００は「排気側傾斜姿勢」で正確に固定され、エンジンシリンダヘッド２００の「軸線２０２」は、ＸＺ軸で形成される平面上でＺ軸と平行な状態となる。その後、ステーションＤの両側にある工作機械１２のＸＺ軸送りユニット６１で制御することによって、主軸頭６３内に納められたスピンドル６６の軸端に取り付けられた工具（図示しない）を、治具１０内に固持されたエンジンシリンダヘッド２００の「軸線２０２」上を沿うように送り出す。

【００９４】これにより、治具１０内に固持されたエンジンシリンダヘッド２００の機能孔２０２Ａ、２０２Ｂ、２０２Ｃの加工が可能となる。但し、ステーションＤにおいては、その両側にある工作機械１２の一方で機能孔２０２Ａの荒加工を行い、他方で機能孔２０２Ｃの荒加工を行っている。そして、工作機械１２のハウジング６２には２個の主軸頭６３が固定され、これらの主軸頭６３内にそれぞれ納められた２本のスピンドル６６は、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって並んでいることから、２本のスピンドル６６の軸端にそれぞれ取り付けられた各工具（図示しない）は、エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔をもって、同時に送り出される。従って、このときは、一方の工作機械１２における１回の送り出しにより、エンジンシリンダヘッド２００に設けられた２個の「燃焼室」の

それぞれにおいて、各機能孔２０２Ａの荒加工が同時に行われる。また、同様にして、他方の工作機械１２による１回の送り出しにより、エンジンシリンダヘッド２００に設けられた２個の「燃焼室」のそれぞれにおいて、各機能孔２０２Ｃの荒加工が同時に行われる。

【００９５】しかし、エンジンシリンダヘッド２００は６気筒４バルブのものであり、１個の「燃焼室」に対して２個の排気バルブが収装されるものであるから、１個の「燃焼室」においては２本の「軸線２０２」が存在する（図１４参照）。すなわち、６個の「燃焼室」を有する１個のエンジンシリンダヘッド２００には、１２本の「軸線２０２」が存在することになる。一方、上述した加工においては、１個のエンジンシリンダヘッド２００において、１２本の「軸線２０２」のうち２本の「軸線２０２」を中心に直列的に点在する機能孔２０２Ａ、２０２Ｃについて行われたのみである。

【００９６】そこで、その後においては、さらに、主軸頭６３内に納められたスピンドル６６の軸端に取り付けられた工具（図示しない）を、工作機械１２のＸＺ軸送りユニット６１で制御することによって、残りの「軸線２０２」を中心に直列的に点在する機能孔２０２Ａ、２０２Ｃの加工が行われる。従って、ステーションＤにおいては、一方の工作機械１２における送り出し、すなわち、一方の工作機械１１２による機能孔２０２Ａの荒加工は６回行われる。同様にして、他方の工作機械１２における送り出し、すなわち、他方の工作機械１２による機能孔２０２Ｃの荒加工は６回行われる。これにより、ステーションＤにおいては、エンジンシリンダヘッド２００の機能孔２０２Ａと機能孔２０２Ｃの全てについて、荒加工が行われる。

【００９７】このようにして、ステーションＤにおける加工が終了すると、ステーションＤの治具１０では、駆動シリンダ３０において、サーボモータ２９でボールネジ２８を引き込ませることにより、「排気側傾斜姿勢」のエンジンシリンダ２００を「横立姿勢」にする。そして、シリンダ３５のロッドを引き込んで、クランパー３４のクランプピン２１をエンジンシリンダヘッド２００から引き離す。同時に、シリンダ５１のロッドを引き込んで、ロケート部材４９のロケートピン５０をエンジンシリンダヘッド２００のロケート孔（図示しない）から外す。これにより、エンジンシリンダヘッド２００の基準面３２に対する接面を解除させることができる。その後、保持部３１に保持されたエンジンシリンダヘッド２００は、図示しないトランスバーによって、下側から受け止められて「横立姿勢」のままで水平に搬送され、ステーションＥの治具１０の固持部３１に送り入れられる。

【００９８】ステーションＥにおいても、上述したステーションＤと同様なことが行われる。但し、その両側にある工作機械１２の一方で機能孔２０２Ｂの荒加工を行った後に他方で機能孔２０２Ｂの仕上加工を行う点と、かかる加工終了後にエンジンシリンダヘッド２００がステーションＦの治具１０の固持部３１に送り入れられる点が異なる。また、ステーションＦにおいても、上述したステーションＤと同様なことが行われる。但し、その両側にある工作機械１２の一方で機能孔２０２Ａの仕上げ加工を行うとともに他方で機能孔２０２Ｃの仕上加工を行う点と、かかる加工終了後にエンジンシリンダヘッド２００が搬出部１０４の姿勢変換装置１７の保持部に送られる点が異なる。

【００９９】尚、図示しないトランスバーによって、エンジンシリンダヘッド２００を「横立姿勢」のままで水平に行われる搬送は、姿勢変換装置１５からステーションＡの治具１０への搬送、ステーションＡの治具１０からステーションＢの治具１０への搬送、ステーションＢの治具１０からステーションＣの治具１０への搬送、ステーションＣの治具１０からステーションＤの治具１０への搬送、ステーションＤの治具１０からステーションＥの治具１０への搬送、ステーションＥの治具１０からステーションＦの治具１０への搬送、ステーションＦの治具１０から搬出部１０４の姿勢変換装置１７への搬送のいずれについても、一本のトランスバーによって同時進行的に行われる。

【０１００】以上より、搬出部１０４に送られたエンジンシリンダヘッド２００においては、全ての機能孔２０２Ａ、２０２Ｂ、２０２Ｃの加工が行われたことになり、もって、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの全ての加工が完了したことになる。その後は、搬出部１０４の姿勢変換装置１７の保持部に保持されたエンジンシリンダヘッド２００は、従来技術の欄で説明した姿勢変換装置１０７と同様なメカニズムで、「横立姿勢」から「正立姿勢」に変換され、図示しないシリンダによって、「正立姿勢」のままで水平にローラコンベヤ１０９上に押し出される。そして、ローラコンベヤ１０９によって、トランスファマシン１の外部に搬出される。

【０１０１】尚、図７に示すように、エンジンシリンダヘッド２００の「軸線２０１」と「軸線２０２」を比べると、「軸線２０１」が「軸線２０２」より高い位置において、ＸＺ軸で形成される平面上でＺ軸と平行な状態となる。そこで、この差の影響を無くすため、工作機械１２では、図１０と図１１に示すように、ＸＺ軸送りユニット６１とハウジング６２の間に、プレート７０が挟設されている。すなわち、プレート７０の厚みをもって調整が行われている。

【０１０２】以上詳細に説明したように、本実施の形態のトランスファマシン１では、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、それらの横の工作機械１２のＸＺ軸送りユニット６１上に並べられた２個の主軸頭６

３の単軸（スピンドル６６）のそれぞれが、１個のモータ６４とカップリング６５で連結されている（図１２参照）。そして、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上において、工作物であるエンジンシリンダヘッド２００が治具１０で固定された際には、各モータ６４で各主軸頭６３の単軸（スピンドル６６）を回転させることにより、各主軸頭６３の単軸（スピンドル６６）の軸端にそれぞれ取り付けられた各工具（図示しない）を回転させることができる。さらに、各主軸頭６３の単軸（スピンドル６６）の軸端にそれぞれ取り付けられた各工具（図示しない）を、ＸＺ軸送りユニット６１により同時に送り出させることができる。

【０１０３】これにより、ステーションＡにおいては、１回の送り出しで、１個のエンジンシリンダヘッド２００に対し、２個の機能孔２０１Ａの荒加工、又は、２個の機能孔２０１Ｃの荒加工を同時に行うことができる。また、ステーションＢにおいては、１回の送り出しで、１個のエンジンシリンダヘッド２００に対し、２個の機能孔２０１Ｂの荒加工、又は、２個の機能孔２０１Ｂの仕上加工を同時に行うことができる。また、ステーションＣにおいては、１回の送り出しで、１個のエンジンシリンダヘッド２００に対し、２個の機能孔２０１Ａの仕上加工、又は、２個の機能孔２０１Ｃの仕上加工を同時に行うことができる。

【０１０４】また、ステーションＤにおいては、１回の送り出しで、１個のエンジンシリンダヘッド２００に対し、２個の機能孔２０２Ａの荒加工、又は、２個の機能孔２０２Ｃの荒加工を同時に行うことができる。また、ステーションＥにおいては、１回の送り出しで、１個のエンジンシリンダヘッド２００に対し、２個の機能孔２０２Ｂの荒加工、又は、２個の機能孔２０２Ｂの仕上加工を同時に行うことができる。また、ステーションＦにおいては、１回の送り出しで、１個のエンジンシリンダヘッド２００に対し、２個の機能孔２０２Ａの仕上加工、又は、２個の機能孔２０２Ｃの仕上加工を同時に行うことができる。

【０１０５】このとき、主軸頭６３の単軸（スピンドル６６）と１個のモータ６４のカップリングに６５よる連結は、従来技術の欄で説明したベルト連結とは異なり（図２１参照）、その構造は単調で他の主軸頭６３や他のモータ６４からは独立して行うことができるものであることから、ＸＺ軸送りユニット上６１に並べられる各主軸頭６３の数を増やしたり減らしたりすることを、大改造することなく簡単に行うことができる。そして、増減の対象となった主軸頭６３やモータ６４やカップリング６５等は、他のトランスファマシン１との間で調達・流用することができる。これにより、トランスファマシン１の製作後においても、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の増減が自在となり、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、１個のエンジンシリンダヘッド２００に対し、１回の送り出しで、同時に加工される機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの数を、変更することができる。

【０１０６】すなわち、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を増加させれば、ＸＺ軸送りユニット６１で同時に送り出される工具（図示しない）の数を増加させることができるので、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、１個のエンジンシリンダヘッド２００に対し、１回の送り出しで、同時に加工される機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの数も増加する。

【０１０７】よって、本実施の形態のように、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆの片側の工作機械１２において、１個のエンジンシリンダヘッド２００に対し、１２個の機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）を加工しなければならない場合で、当該工作機械１２のＸＺ軸送りユニット６１上に並べられる主軸頭６３の数が２個のときには、当該ＸＺ軸送りユニット６１で同時に送り出される工具（図示しない）の数も２個なので、１個のエンジンシリンダヘッド２００に対し、１２個の機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）を加工するためには、当該ＸＺ軸送りユニット６１による各工具（図示しない）の同時送り出しを６回行う必要がある。

【０１０８】しかしながら、例えば、当該工作機械１２のＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を１個増やした３個のときには、当該ＸＺ軸送りユニット６１で同時に送り出される工具（図示しない）の数も３個に増えるので、１個のエンジンシリンダヘッド２００に対し１２個の機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）を加工するためには、当該ＸＺ軸送りユニット６１による各工具（図示しない）の同時送り出しは４回行うだけでよい。さらに、当該工作機械１２のＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を３個増やした６個のときには、当該ＸＺ軸送りユニット６１で同時に送り出される工具（図示しない）の数も６個に増えるので、１個のエンジンシリンダヘッド２００に対し１２個の機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）を加工するためには、当該ＸＺ軸送りユニット６１による各工具（図示しない）の同時送り出しは２回行うだけでよい。

【０１０９】このようにして、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を増加させれば、ＸＺ軸送りユニット６１による各工具（図示しない）の同時送り出し回数を減少させることができ、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおける加工に必要な時間は短縮されるので、トランスファマシン１の最大生産能力を

向上させることができる。よって、トランスファマシン１が製作された後でも、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を増加させることにより、トランスファマシン１の最大生産能力を増強させることができる。これにより、トランスファマシン１の最大生産能力を、予想される最大生産量に十分に対応できるようにする必要はなくなり、当初の最大生産能力を予想される通常の生産量に対応できるものとし、予想される最大生産量が現実のものとなったときに、当初の最大生産能力を増強させることが可能となる。

【０１１０】逆に、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を減少させれば、ＸＺ軸送りユニット６１で同時に送り出される工具（図示しない）の数を減少させることができるので、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、１個のエンジンシリンダヘッド２００に対し、１回の送り出しで同時に加工される機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）の数も減少する。よって、トランスファマシン１が製作された後でも、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の数を減少させることにより、トランスファマシン１の最大生産能力を削減させることができる。尚、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の数が１個となっても、同様な効果を発揮できる。

【０１１１】以上より、当初の最大生産能力を低く抑えることができるので、イニシャルコストの低減に貢献することができる。また、その後、最大生産能力を増強させる場合には、他のトランスファマシン１で不要となった主軸頭６３やモータ６４やカップリング６５などを流用することができる一方、生産量を減少させる場合には、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆに搬送されるエンジンシリンダヘッド２００のピッチタイムを大きくすることによって対応するだけでなく、最大生産能力を削減させることによっても対応することができる。そして、最大生産能力を削減させるときには、不要となった主軸頭６３やモータ６４やカップリング６５などを他のトランスファマシン１に流用させることができる。従って、最大生産能力の増強・削減の際に新たな設備投資は殆どかからない。

【０１１２】さらに、当該トランスファマシン１内において、または、他のトランスファマシン１との間において、調達・流用される主軸頭６３やモータ６４やカップリング６５などは共通したものを使用するので、設計費用が安価となる。また、カップリング６５による連結構造は単調で構成部品点数も少ないので、製作費用が安価となる。これらの観点からも、イニシャルコストの低減に貢献することができる。

【０１１３】また、図１０や図１２に示すように、ＸＺ軸送りユニット６１上に主軸頭６３の単軸（スピンドル６６）を並べる際には、ＸＺ軸送りユニット６１上に取り付けられるハウジング６２を介して行われる。かかるハウジング６２には、２個の主軸頭６３が並列的に固定される場所が予め所定のピッチ間隔（エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔）で設けられてあり、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の増減を自在に行うことをさらに容易にしている。尚、かかる主軸頭６３の数を３個以上にするときは、ハウジング６２を、３個以上の主軸頭６３を固定できるものに取り替える。これにより、ＸＺ軸送りユニット６１上に並べられる主軸頭６３のピッチ間隔（エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔）は確保され、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、１個のエンジンシリンダヘッド２００に対し、１回の送り出しで同時に加工される機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）について、それらのピッチ間隔（エンジンシリンダヘッド２００に設けられた６個の「燃焼室」のピッチ間隔）の保障がなされる。

【０１１４】従って、ＸＺ軸送りユニット６１上に取り付けられるハウジング６２を、ピッチ間隔の値が異なる他のハウジング６２に取り替えることにより、ＸＺ軸送りユニット６１上に並べられる主軸頭６３のピッチ間隔の設定を自在にすることができ、もって、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、１個のエンジンシリンダヘッド２００に対し、１回の送り出しで同時に加工される機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）について、それらのピッチ間隔を変更することが可能となる。

【０１１５】特に、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃは、エンジンの多気筒化により、等間隔に複数設けられるのが通常であり、かかるピッチ間隔は、エンジンシリンダヘッド２００の種類により相違することが多いので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替わる場合には、主軸頭６３の単軸（スピンドル６６）のピッチ間隔の変更を必要とすることが多い。そして、このとき、主軸頭６３の単軸（スピンドル６６）のピッチ間隔の変更は、大幅に改造することなく単にハウジング６２を取り替えるだけでできるので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替えられても、過大な追加投資が必要となることはない。

【０１１６】また、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上に設置される冶具１０は、エンジンシリンダヘッド２００を固持しながらその傾斜姿勢を自由に制御することができる（図７参照）。従って、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて、１個のエンジンシリンダヘッド２００に対し、１回の送り出しで同時に加工

される機能孔（２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのいずれか１つ）の傾斜角度を変更することができる。

【０１１７】特に、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃは、その機能を確保するため、傾斜して設けられるものが多く、かかる傾斜角度は、エンジンシリンダヘッド２００の種類により相違することが通常であるので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッドに切り替わる場合には、エンジンシリンダヘッド２００の傾斜姿勢の変更を必要とすることが多い。そして、このとき、エンジンシリンダヘッド２００の傾斜姿勢の変更は、治具１０を大幅に改造することなく単に治具１０による制御だけでできるので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替えられても、過大な追加投資が必要となることはない。

【０１１８】また、エンジンシリンダヘッド２００の傾斜角度は、異なる種類のエンジンシリンダヘッド２００間だけでなく、例えば、本実施の形態のように、１個のエンジンシリンダヘッド２００内でも、「吸気側傾斜姿勢」と「排気側傾斜姿勢」のように相違することがあるので、同じエンジンシリンダヘッド２００であっても、加工対象の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃが異なる場合には、エンジンシリンダヘッド２００の傾斜姿勢の変更を必要とすることが多い。そして、このとき、エンジンシリンダヘッド２００の傾斜姿勢の変更は、従来技術のように「吸気側傾斜姿勢」と「排気側傾斜姿勢」ごとに専用の治具１０を設けるのではなく、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆにおいて共通の治具１０による制御だけでできるので、治具１０の共通化により設計費用が安価となり、イニシャルコストの低減に貢献することができる。

【０１１９】また、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上に設置される治具１０では、エンジンシリンダヘッド２００を固持する際に、ロケート部材４９に設けられたロケートピン５０で、エンジンシリンダヘッド２００の位置決めを確保している（図４など参照）。そして、かかるロケート部材４９においては、エンジンシリンダヘッド２００に設けられたロケート孔（図示しない）に対応するように、ロケートピン５０の位置や長さなどの配設状態が決定されている。従って、治具１０に取り付けられるロケート部材４９を、ロケートピン５０の配設状態が異なる他のロケート部材４９に取り替えることによって、ロケートピン５０の配設状態を変更することができる。

【０１２０】特に、エンジンシリンダヘッド２００の表面形状は、エンジンシリンダヘッド２００の種類により相違することが多いので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替わる場合には、エンジンシリンダヘッド２００に設けられるロケート孔（図示しない）の位置などは変更を余儀なくされることが多く、ロケートピン５０の配設状態の変更を必要とすることも多い。そして、このとき、ロケートピン５０の配設状態の変更は、治具１０を大幅に改造することなく単にロケート部材４９を取り替えるだけでできるので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替えられても、過大な追加投資が必要となることはない。

【０１２１】また、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上に設置される治具１０では、エンジンシリンダヘッド２００を固持する際に、クランパー３４に設けられたクランプピン２１で、エンジンシリンダヘッド２００を固持している（図７など参照）。そして、かかるクランパー３４においては、エンジンシリンダヘッド２００に圧接される箇所を考慮して、クランプピン２１の位置や長さなどの配設状態が決定されている。従って、治具１０に取り付けられるクランパー３４を、クランプピン５０の配設状態が異なる他のクランパー３４に取り替えることによって、クランプピン５０の配設状態を変更することができる。

【０１２２】特に、エンジンシリンダヘッド２００の表面形状は、エンジンシリンダヘッド２００の種類により相違することが多いので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替わる場合には、エンジンシリンダヘッド２００に圧接される箇所などは変更を余儀なくされることが多く、クランプピン２１の配設状態の変更を必要とすることも多い。そして、このとき、クランプピン２１の配設状態の変更は、治具１０を大幅に改造することなく単にクランパー３４を取り替えるだけでできるので、エンジンシリンダヘッド２００が異なる種類のエンジンシリンダヘッド２００に切り替えられても、過大な追加投資が必要となることはない。

【０１２３】すなわち、本実施の形態のトランスファマシン１では、ＸＺ軸送りユニット６１上に並べられる主軸頭６３の増減を自在にしたことから、その製作後に最大生産能力の増強・削減が可能となり、当初の最大生産能力を低く抑えることができるので、イニシャルコストの低減に貢献することができ、また、主軸頭６３やモータ６４やカップリング６５などは流用することができることから、設計費用が安価で済むとともに、最大生産能力の増強・削減の際に新たな設備投資は殆どかかることがなく、さらに、主軸頭６３やモータ６４の連結構造は単調なものであるから、その製作費用も安価で済ませることができるので、工作物であるエンジンシリンダヘッド２００の生産量の変動に対して、低コストで対応することができる。

【０１２４】また、ハウジング６２の取り替え、治具１０による制御、ロケート部材４９の取り替え、クランパ

ー３４の取り替えによって、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃのピッチ間隔の変更、エンジンシリンダヘッド２００の機能孔２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、２０２Ｃの傾斜角度の変更、エンジンシリンダヘッド２００のロケート孔（図示しない）の位置の変更、エンジンシリンダヘッド２００に対するクランプピン５０の圧接箇所の変更に対応することができ、その際に、過大な追加投資が必要となることはないので、工作物である「エンジンシリンダヘッド２００の切替」に対して、低コストで対応することができる。

【０１２５】尚、工作物であるエンジンシリンダヘッド２００の生産量の変動や、工作物である「エンジンシリンダヘッド２００の切替」の際には、ＸＺ軸送りユニット６１の制御に対するプログラム変更や、各主軸頭６３の単軸（スピンドル６６）の軸端にそれぞれ取り付けられる各工具（図示しない）の変更などを伴う場合があるが、それらについては、いずれも低コストで対応することができる。

【０１２６】また、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆ上に設置される治具１０においては、エンジンシリンダヘッド２００の傾斜姿勢を自由に制御することができることから、治具１０による固持が解除される際のエンジンシリンダヘッド２００の姿勢を全ステーションにおいて「横立姿勢」に共通化させることが可能となり、これにより、各ステーションＡ、Ｂ、Ｃ、Ｄ、Ｅ、Ｆに対する搬送時や搬出時のエンジンシリンダヘッド２００の姿勢も「横立姿勢」で共通化させることができるので、従来技術の欄で述べた姿勢変換装置１０６に相当するものをなくすことができ、この観点からも、イニシャルコストを低く抑えることができる。

【０１２７】また、主軸頭６３の増減、ハウジング６２の取り替え、ロケート部材４９の取り替え、クランパー３４の取り替えに要する時間は、従来技術の大幅な改造に要する時間と比べて、格段に短いので、長期間にわたる生産のシャットダウンを防止することができ、この観点からも、設備投資の収益性を高くすることができる。

【０１２８】また、従来技術の欄で述べた姿勢変換装置１０６に相当するものをなくしたことにより、図１８の中間部１０３をもなくすことが可能となり、トランスファマシン１の占有面積を減少させることができる（図１参照）。

【０１２９】また、図１２に示すように、主軸頭６３の単軸（スピンドル６６）のそれぞれは、１個のモータ６４とカップリング６５で連結されており、いわゆる１軸構成のモータダイレクト駆動の構成を有しているので、従来技術の欄で説明したベルト連結と比べ（図２１参照）、各主軸頭６３の単軸（スピンドル６６）の軸端にそれぞれ取り付けられた各工具（図示しない）を高速で回転させることができる。

【０１３０】さらに、本実施の形態のトランスファマシン１は、いわゆる１軸構成のモータダイレクト駆動の構成を有することにより、従来技術の欄で説明したベルト連結を有するトランスファマシン１００と比べて（図２１参照）、設備高さ低くを抑えることができ、設備全体の見通し性が良くなるので、安全性と保全性の向上に貢献することができる。

【０１３１】また、主軸頭６３は単軸のため、主軸頭６３の外形形状を円形状にすることができる。そして、その円形状に対応する円形状のシール（スクレーパ）を、治具１０のみを覆うカバーに備えることが可能となり、治具１０内において発生する切削時の切粉やクーラント液が外部へ飛散することを、かかるカバーによって効率よく防止することができる。すなわち、従来技術のトランスファマシン１００においては、ギヤボックス１４１の外形形状が長方形をしており、かかる長方形のシール性の困難さから、トランスファマシン１００全体をカバーで覆っていたので、本実施の形態のトランスファマシン１においては、カバーのコンパクト化が図られ、製作費用を低減させることができる。

【０１３２】また、従来技術のトランスファマシン１００でのトランスバー（図示しない）による搬送においては、エンジンシリンダヘッド２００を「吸気側傾斜姿勢」又は「排気側傾斜姿勢」で搬送している。しかし、本実施の形態のトランスファマシン１でのトランスバー（図示しない）による搬送においては、エンジンシリンダヘッド２００を「横立姿勢」で搬送しており、「吸気側傾斜姿勢」や「排気側傾斜姿勢」と比べ、搬送時の安定性がより優れていると言える。従って、治具１０の保持部３１に送り入れたり、送り出したりする際において、エンジンシリンダヘッド２００や治具１０が互いに干渉し傷つくおそれがない。

【０１３３】尚、本発明は上記実施の形態に限定されるものでなく、その趣旨を逸脱しない範囲で様々な変更が可能である。例えば、搬入部１０２のローラコンベヤ１０８と、搬出部１０４のローラコンベヤ１０９において、エンジンシリンダヘッド２００を「正立姿勢」でなく「横立姿勢」で搬送するようにすれば、エンジンシリンダヘッド２００を「正立姿勢」から「横立姿勢」に変換する姿勢変換装置１５と、エンジンシリンダヘッド２００を「横立姿勢」から「正立姿勢」に変換する姿勢変換装置１７をなくすことができるので、さらに、イニシャルコストを低く抑えることができる。

【０１３４】

【発明の効果】本発明のトランスファマシンでは、ＸＺ軸送りユニット上に並べられる主軸頭の増減を自在にしたことから、その製作後に最大生産能力の増強・削減が可能となり、当初の最大生産能力を低く抑えることができるので、イニシャルコストの低減に貢献することがで

き、また、主軸頭やモータやカップリングなどは流用することができることから、設計費用が安価で済むとともに、最大生産能力の増強・削減の際に新たな設備投資は殆どかかることがなく、さらに、主軸頭やモータの連結構造は単調なものであるから、その製作費用も安価で済ませることができるので、工作物であるエンジンシリンダヘッドの生産量の変動に対して、低コストで対応することができる。

【０１３５】また、ハウジングの取り替え、治具による制御、ロケート部材の取り替え、クランプ部材の取り替えによって、エンジンシリンダヘッドの機能孔のピッチ間隔の変更、エンジンシリンダヘッドの機能孔の傾斜角度の変更、エンジンシリンダヘッドのロケート孔の位置の変更、エンジンシリンダヘッドに対するクランプピンの圧接箇所の変更に対応することができ、その際に、過大な追加投資が必要となることはないので、工作物である「エンジンシリンダヘッドの切替」に対して、低コストで対応することができる。

【０１３６】また、各ステーション上に設置される治具においては、エンジンシリンダヘッドの傾斜姿勢を自由に制御することができることから、治具による固持が解除される際のエンジンシリンダヘッドの姿勢を全ステーションにおいて共通化させることが可能となり、これにより、各ステーションに対する搬送時や搬出時のエンジンシリンダヘッドの姿勢も共通化させることができるので、従来技術の欄で述べた３個の姿勢切り替え装置のうち一部又は全部をなくすことが可能となり、この観点からも、イニシャルコストを低く抑えることができる。

【０１３７】また、主軸頭の増減、ハウジングの取り替え、ロケート部材の取り替え、クランプ部材の取り替えに要する時間は、従来技術の大幅な改造に要する時間と比べて、格段に短いので、長期間にわたる生産のシャットダウンを防止することができ、この観点からも、設備投資の収益性を高くすることができる。

【図面の簡単な説明】

【図１】本発明のトランスファマシンの概要を示した正面図である。

【図２】本発明のトランスファマシンにおける治具を示した正面図である。

【図３】本発明のトランスファマシンにおける治具を示した背面図である。

【図４】本発明のトランスファマシンにおける治具の本体の基準面を示した正面図である。

【図５】図４のＲ－Ｒ線に沿う平面において切断した部分断面図であって、治具のロケート部材の駆動系の概要を示したものである。

【図６】図４のＲ－Ｒ線に沿う平面において切断した部分断面図であって、治具のロケート部材の駆動系の概要を示したものである。

【図７】本発明のトランスファマシンにおける治具を示した側面図である。

【図８】図２～図７に示されたものとは異なる治具を正面側から見た斜視図である。

【図９】図８に示す治具を背面側から見た斜視図である。

【図１０】本発明のトランスファマシンにおける加工機械の概要をＺ軸から示した正面図である。

【図１１】本発明のトランスファマシンにおける加工機械の概要をＸ軸から示した正面図である。

【図１２】図１０のＳ－Ｓ線でハウジングをのみ切断した部分断面図である。

【図１３】図１４のＰ－Ｐ線に沿う平面において切断した断面図であって、エンジンシリンダヘッドの「横立姿勢」のときのものである。

【図１４】エンジンシリンダヘッドの一例を「燃焼室」側から示した平面図である。

【図１５】図１４のＰ－Ｐ線に沿う平面において切断した断面図であって、エンジンシリンダヘッドの「正立姿勢」のときのものである。

【図１６】図１４のＰ－Ｐ線に沿う平面において切断した断面図であって、エンジンシリンダヘッドの「吸気側傾斜姿勢」のときのものである。を示したものである。

【図１７】図１４のＰ－Ｐ線に沿う平面において切断した断面図であって、エンジンシリンダヘッドの「排気側傾斜姿勢」のときのものである。

【図１８】従来技術のトランスファマシンの概要を示した正面図である。

【図１９】従来技術のトランスファマシンにおける姿勢変換装置を示した正面図である。

【図２０】従来技術のトランスファマシンにおける治具を示した断面図である。

【図２１】従来技術のトランスファマシンにおける加工機械を示した正面図である。

【図２２】図２１のＱ－Ｑ線に沿う平面において切断した断面図である。

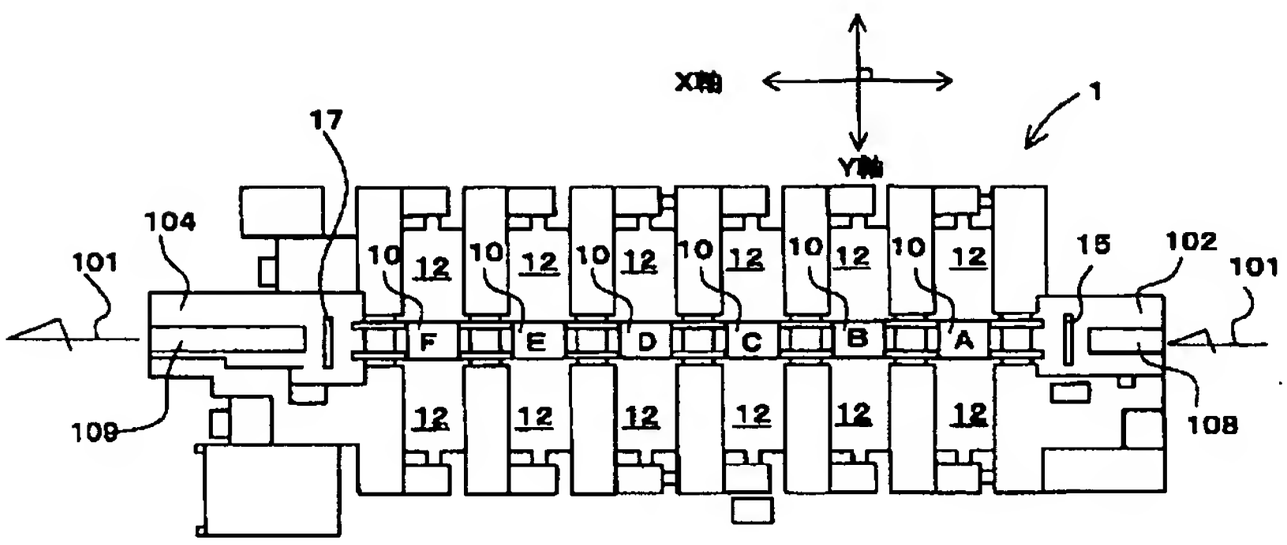
【符号の説明】

１　トランスファマシン
１０　治具
２１　クランプピン
３４　クランパー
４９　ロケート部材
５０　ロケートピン
６１　ＸＺ軸送りユニット
６２　ハウジング
６３　主軸頭
６４　モータ
６５　カップリング
６６　スピンドル
２００　エンジンシリンダヘッド
２０１Ａ、２０１Ｂ、２０１Ｃ、２０２Ａ、２０２Ｂ、

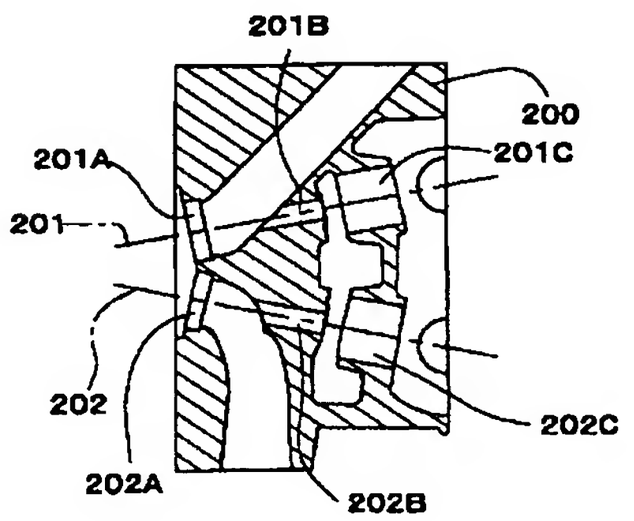
202C　機能孔

A、B、C、D、E、F　ステーション

【図1】



【図13】



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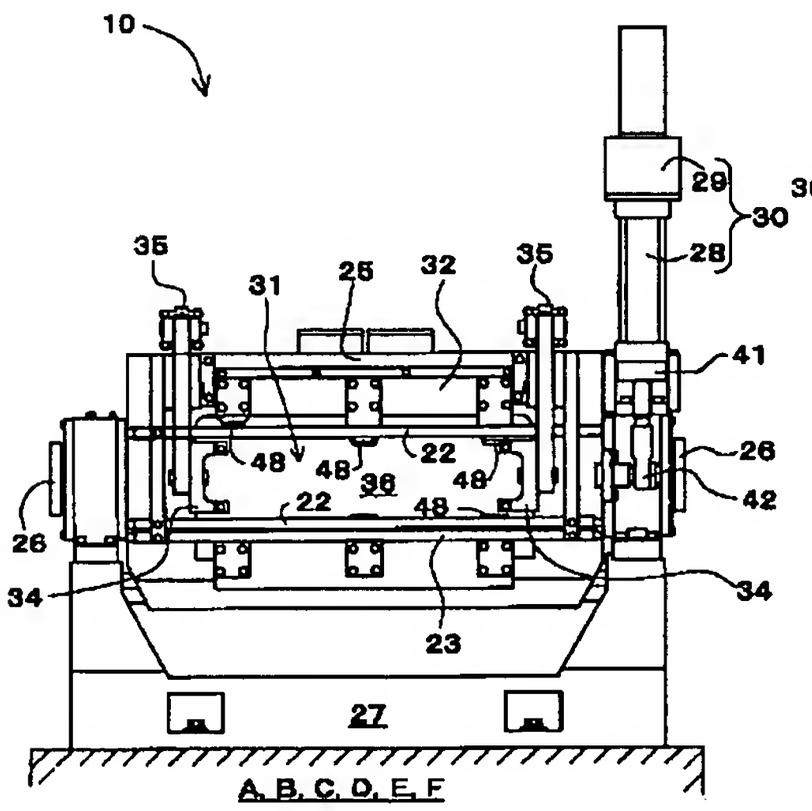

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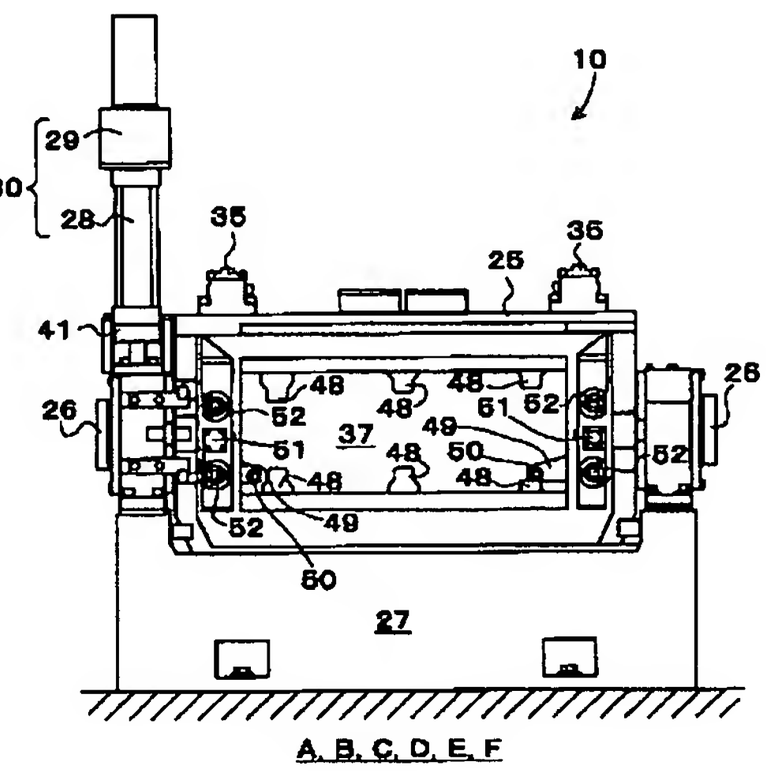

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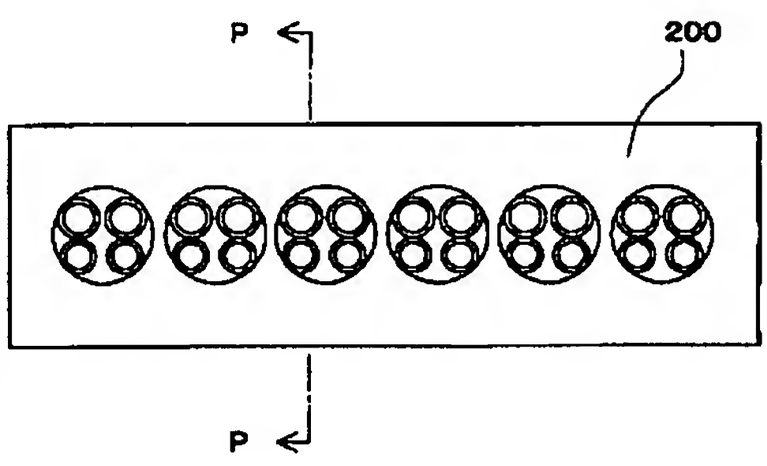

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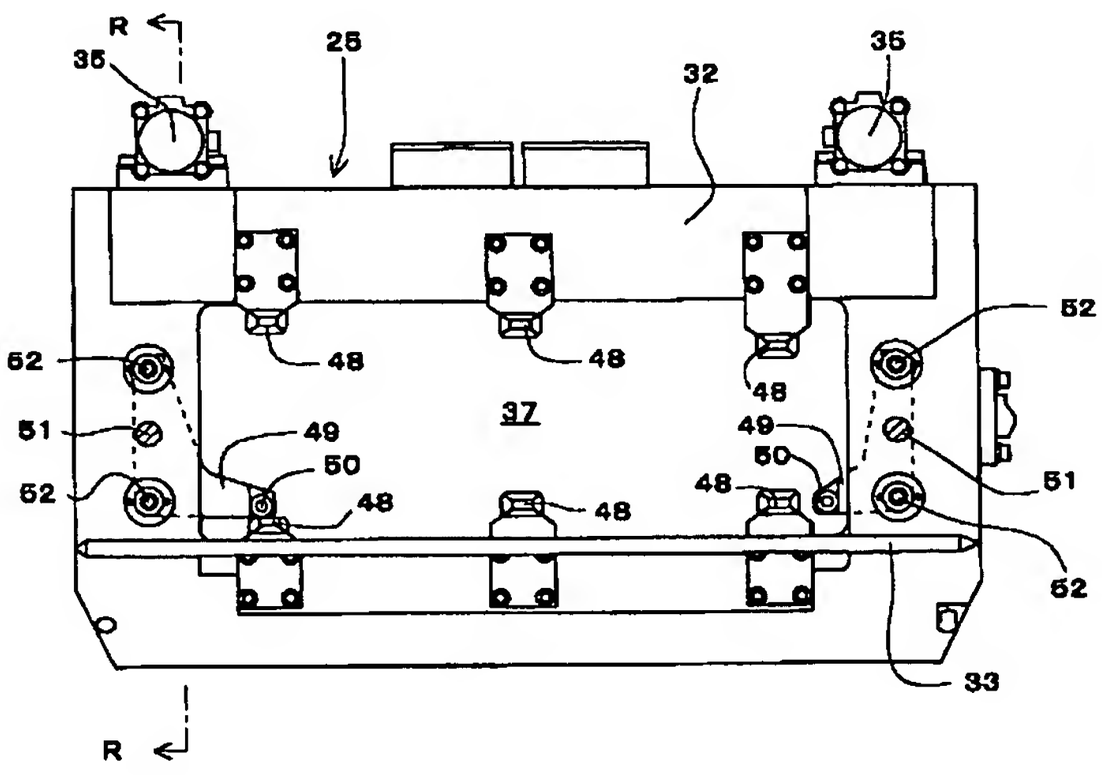

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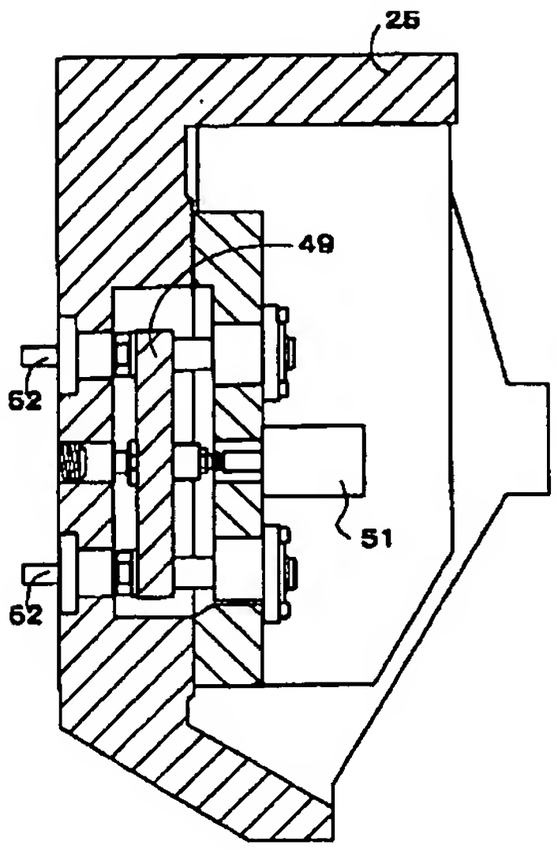

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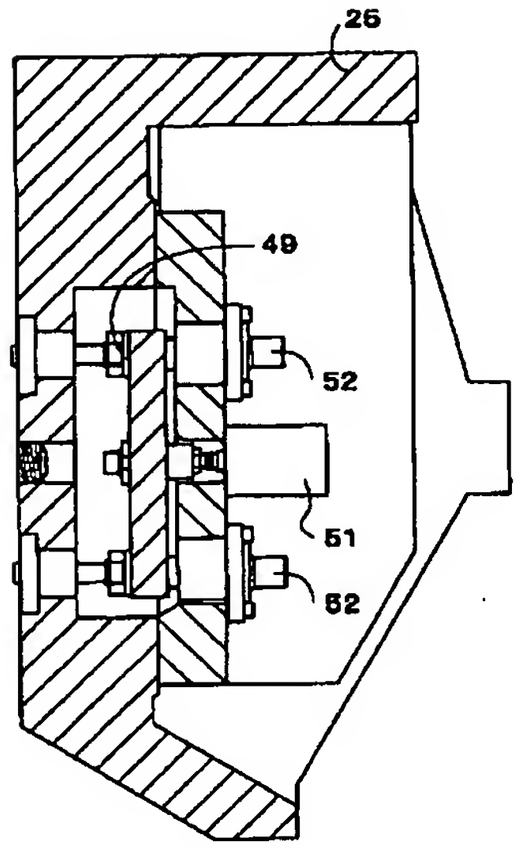

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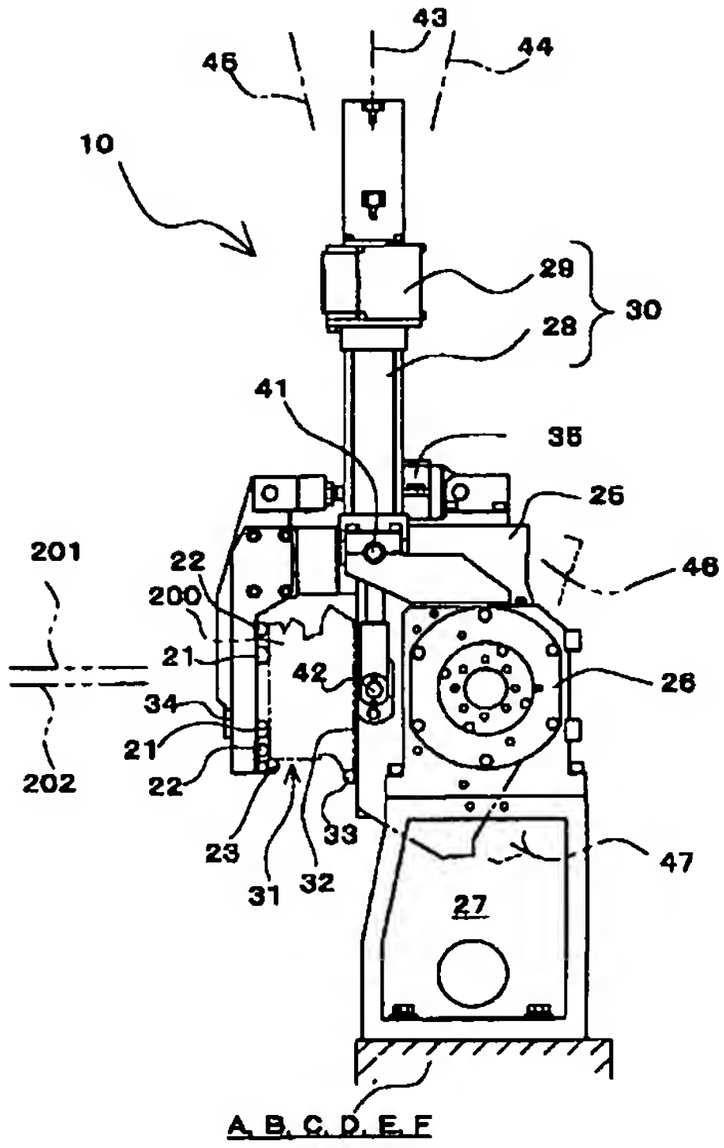

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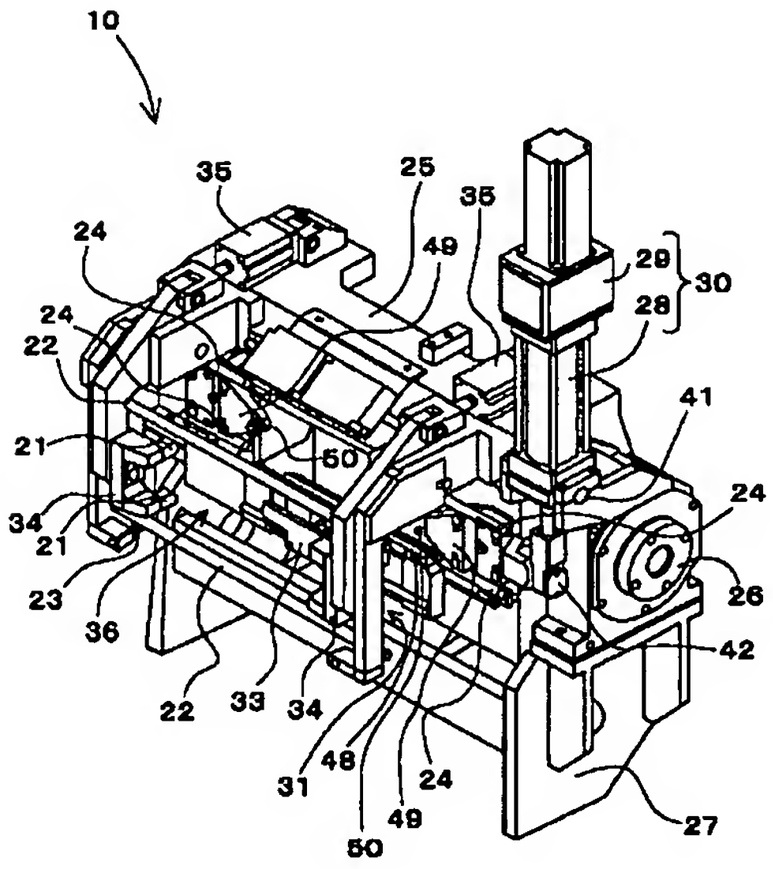

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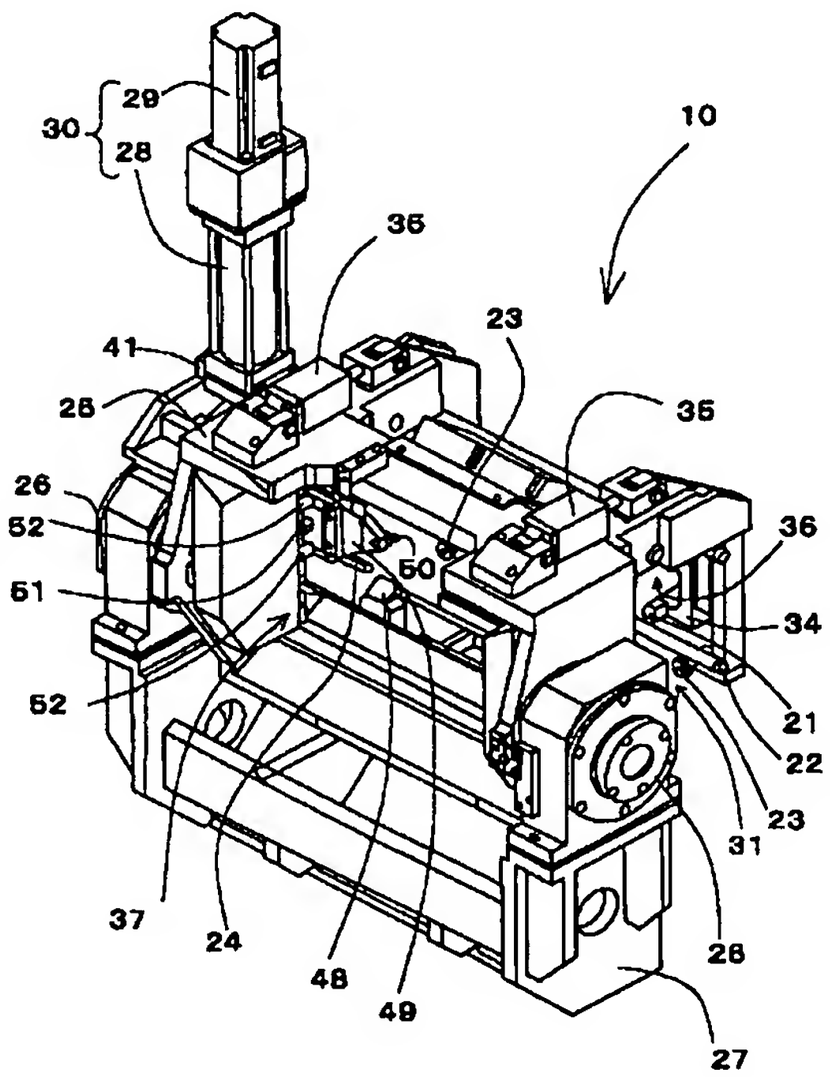

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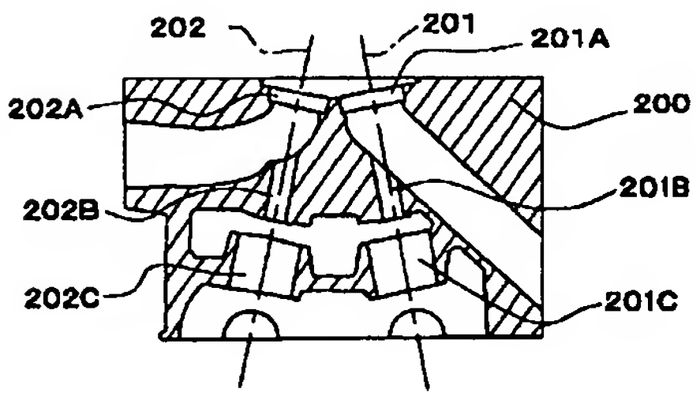

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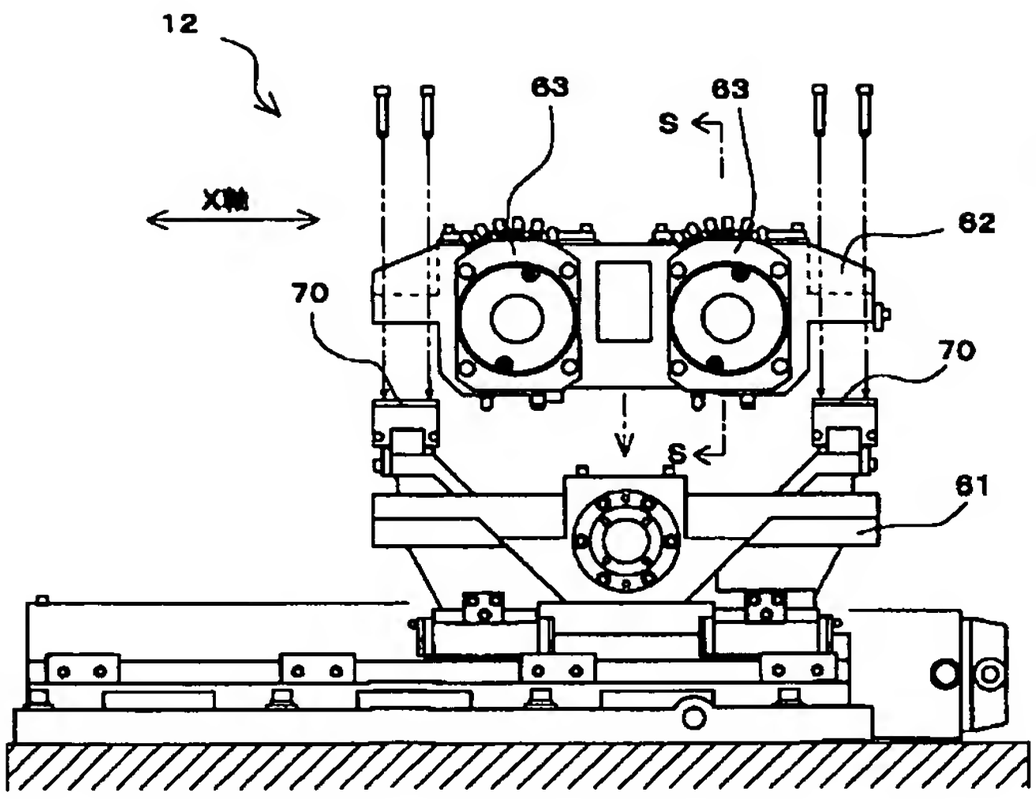

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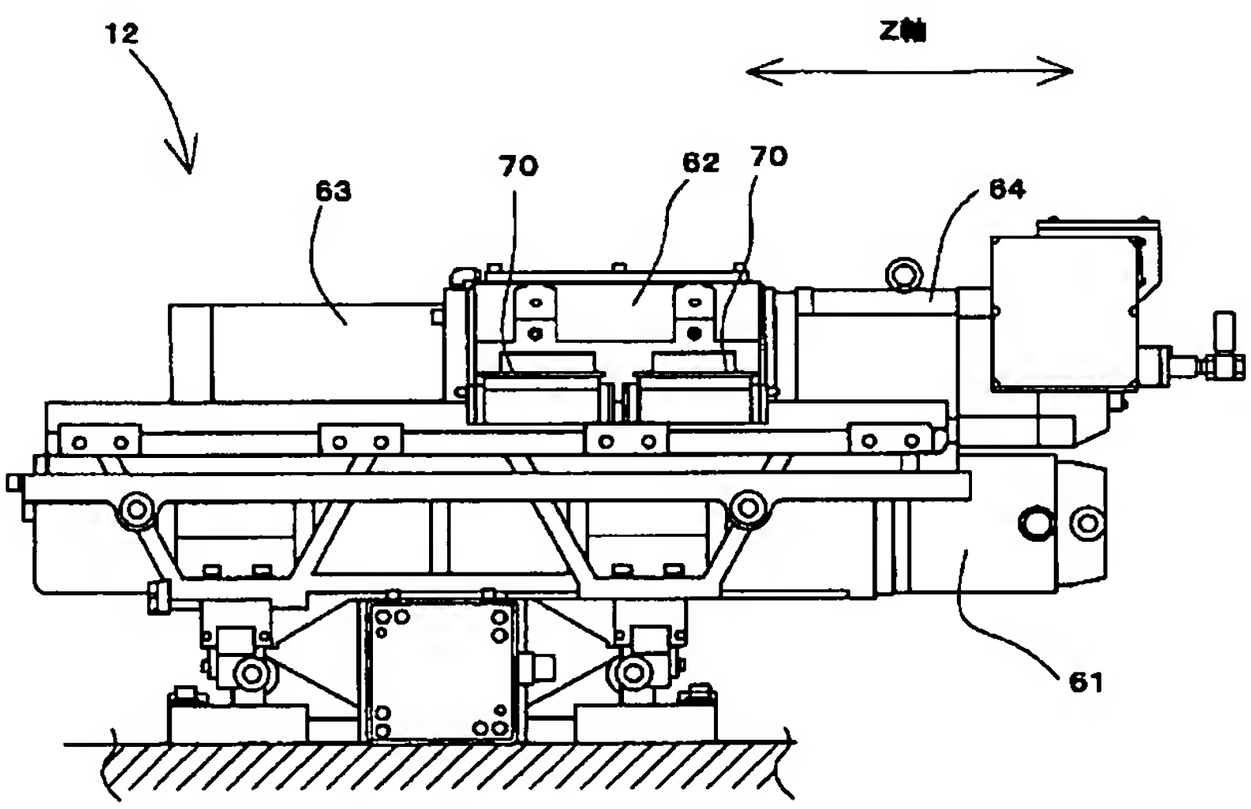

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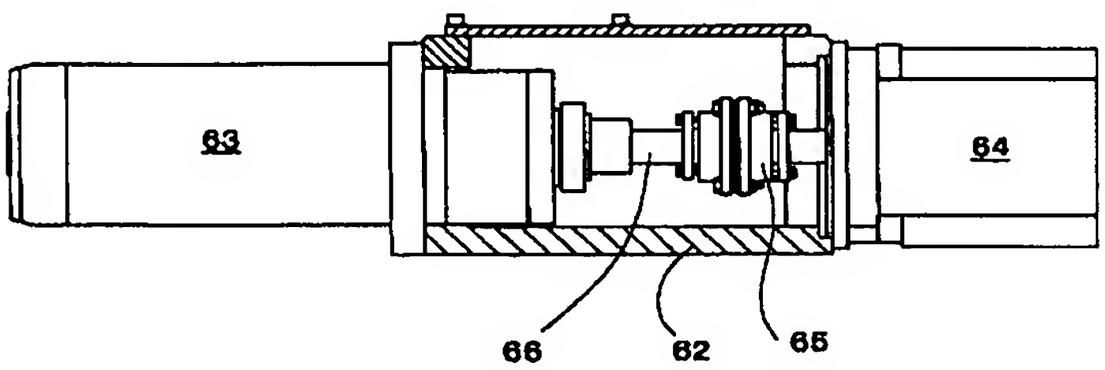

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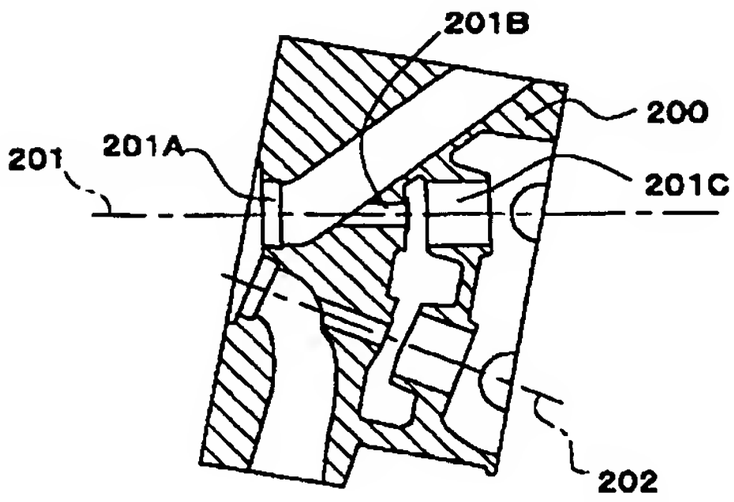

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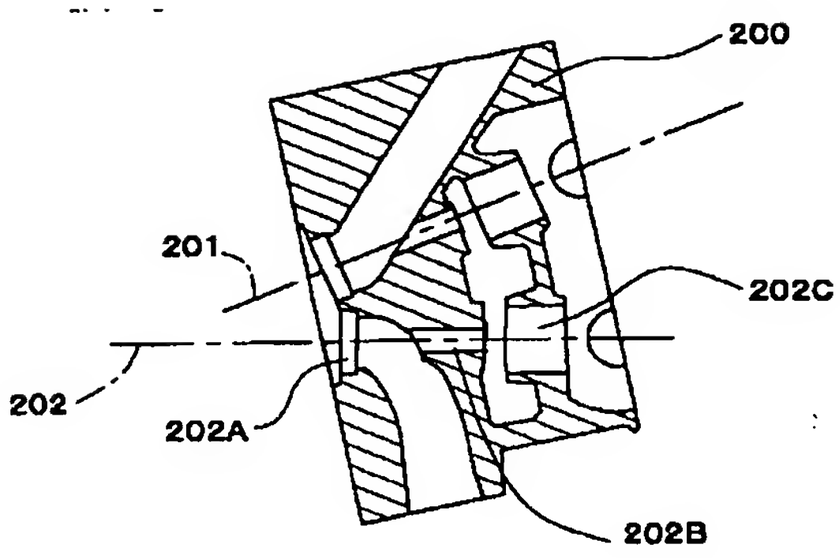

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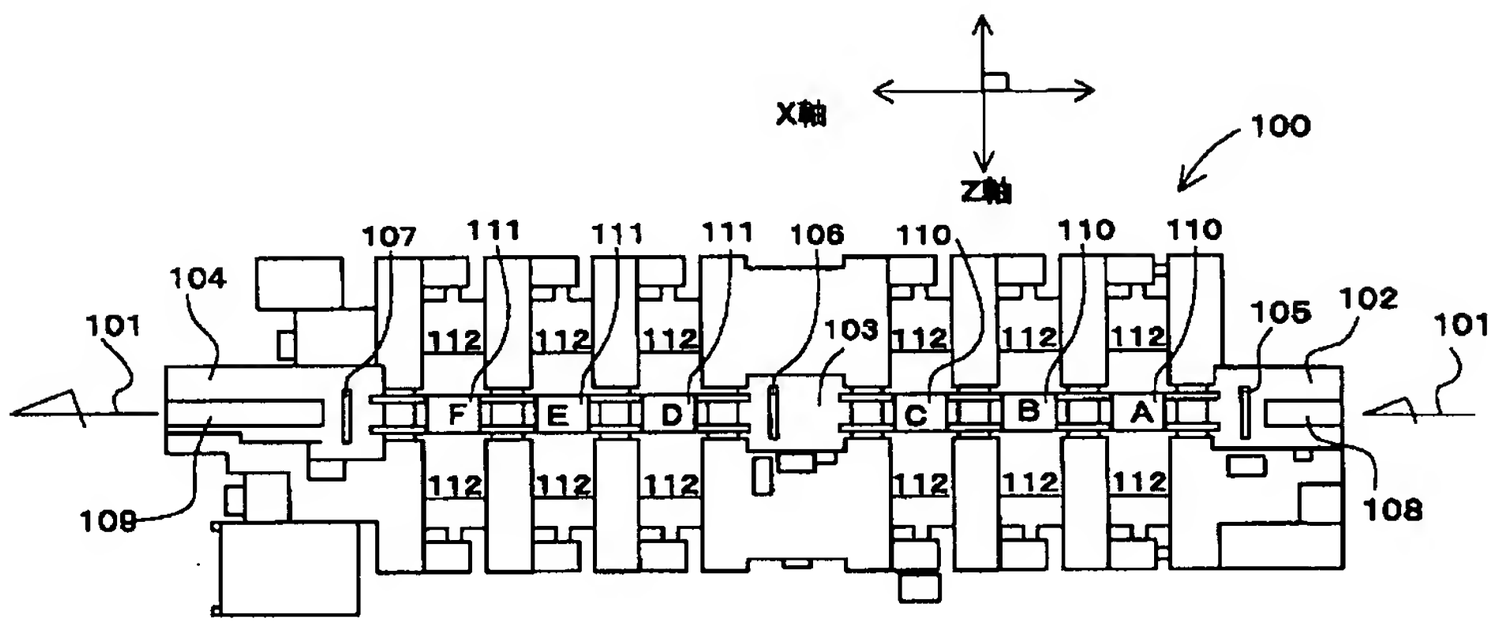

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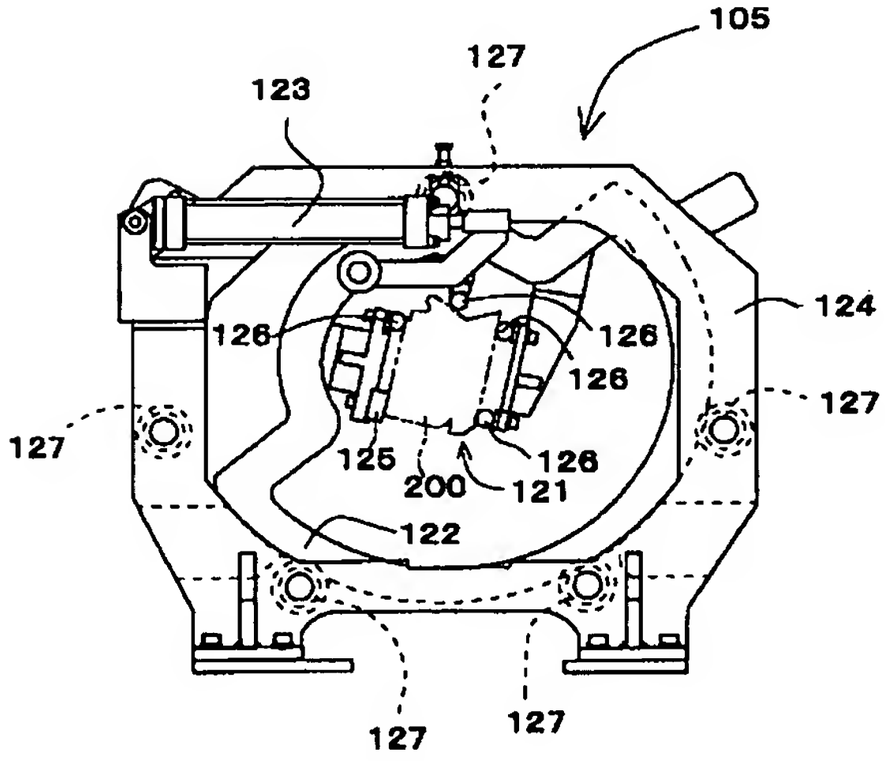

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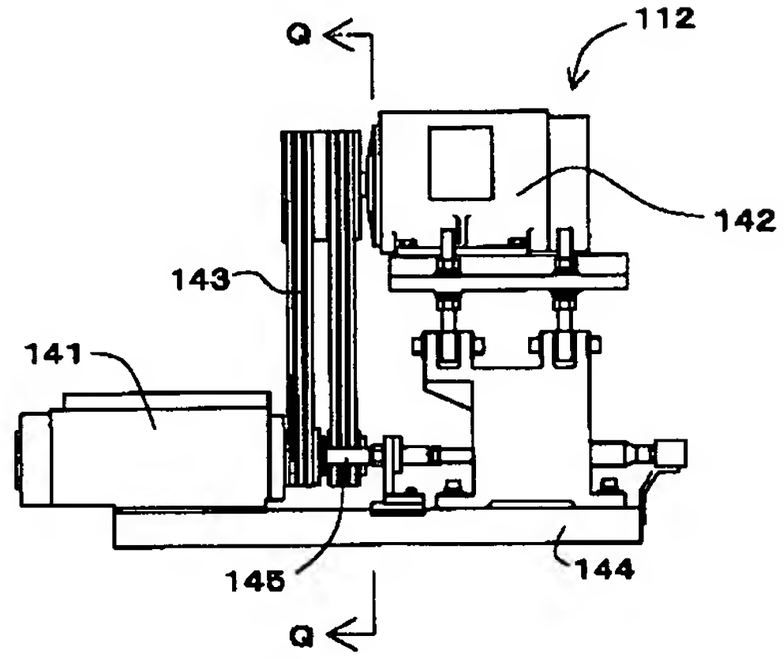

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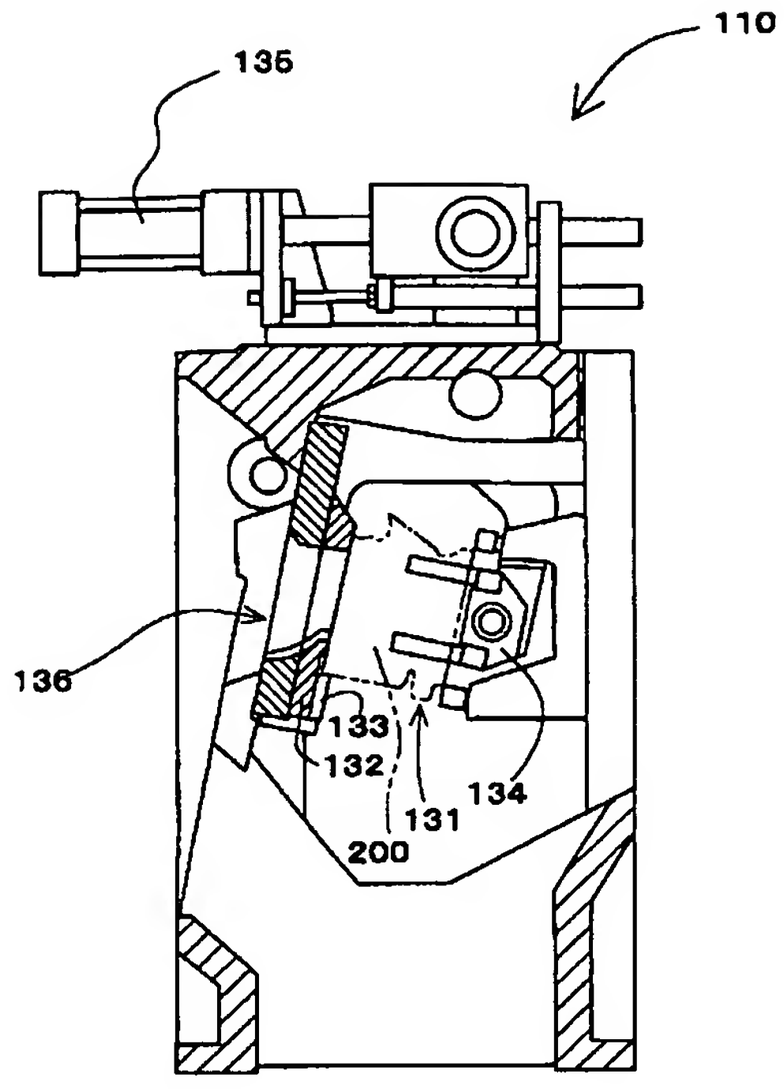

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Fターム(参考)　3C042 RA11 RB11 RC02 RC08 RD01
3C045 AA10 BA05 BA37 BA40 CA30
DA21 EA04 FA09 FD01 FE20

CLAIMS

[Claim(s)]
[Claim 1] By sending out to coincidence in XZ shaft delivery unit, rotating each tool attached in the axis end of two or more spindles arranged beside [each] the station, respectively, when the engine cylinder head is fixed on each station While processing many functional holes into coincidence by 1 time of the send to the one engine cylinder head at each station By conveying the one engine cylinder head one by one to each station While arranging in on said XZ shaft delivery unit the spindle head of the monopodium which dedicated only one spindle in the transfer machine which performs processing to the functional hole of the one engine cylinder head in order of each process and sending out each tool to coincidence By making one spindle in each spindle head connect with one motor by coupling, and rotating each tool The transfer machine which enables the change in the spindle head arranged in on said XZ shaft delivery unit, and is characterized by the ability to change the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station.
[Claim 2] The transfer machine characterized by securing pitch spacing of the functional hole which secures pitch spacing of the spindle head arranged in on said XZ shaft delivery unit by attaching housing with which said spindle head is fixed in juxtaposition on said XZ shaft delivery unit in the transfer machine indicated to claim 1, and is processed into coincidence by 1 time of the send to the one engine cylinder head at each station.
[Claim 3] The transfer machine which enables a setup of pitch spacing of the spindle head arranged in on said XZ shaft delivery unit by exchanging said housing in said housing and other compatible housing in the transfer machine indicated to claim 2 , and is characterized by the ability to change pitch spacing of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station .
[Claim 4] When the engine cylinder head is fixed with an inclination posture on each station By sending out to coincidence in XZ shaft delivery unit, rotating each tool attached in the axis end of two or more spindles arranged beside [each] the station, respectively While processing many functional holes into coincidence by 1 time of the send to the one engine cylinder head at each station By conveying the one engine cylinder head one by one to each station In the transfer machine which performs processing to the functional hole of the one engine cylinder head in order of each process By controlling the inclination posture of said engine cylinder head, insisting upon said engine cylinder head with the jig installed on each station The transfer machine characterized by the ability to change whenever [tilt-angle / of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station].
[Claim 5] The transfer machine characterized by the ability to change the arrangement condition of said locator pin by attaching in said jig the ROKETO member in which the locator pin for securing positioning of said engine cylinder head was prepared in the transfer machine indicated to claim 4, and exchanging said ROKETO member to said ROKETO member and other compatible ROKETO members.
[Claim 6] The transfer machine characterized by the ability to change the arrangement condition of said

clamp pin by attaching in said jig the clamp member in which the clamp pin for insisting upon said engine cylinder head was prepared in the transfer machine indicated to claim 4 or claim 5, and exchanging said clamp member to said clamp member and other compatible clamp members.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the transfer machine into which the functional hole (here, what forms a bearing surface is included) of the engine cylinder head is processed.
[0002]
[Description of the Prior Art] Before, various functional holes, such as a path of the hole which lets a part of combustion chamber (only henceforth a "combustion chamber"), a water jacket, and an intake valve and an exhaust air bulb pass, the inhalation-of-air hole and exhaust hole which are a gas passageway, the hole in which a plug is inserted, and a lubricating oil, are intricately prepared in the engine cylinder head which is the head of engines, such as an automobile. For example, in the top view of drawing 14 , when the P-P line of drawing 14 cuts the engine cylinder head 200 of 6-cylinder 4 bulb shown from the "combustion chamber side", it turns out that it comes to be shown in drawing 15 and various functional holes are prepared intricately. In addition, in drawing 14 , a total of four holes of the hole which lets two intake valves pass, and the hole which lets two exhaust air bulbs pass can be seen in each of six "combustion chambers."
[0003] And as shown in drawing 15 , about the circumference of the axis 201 (only henceforth "an axis 201") of the intake valve at the time of being installed inside by the engine cylinder head 200, it is dotted with the functional holes 201A, 201B, and 201C with which paths differed focusing on the starting "axis 201" in serial. It is dotted with the functional holes 202A, 202B, and 202C with which paths differed focusing on the "axis 202" which similarly starts also about the circumference of the axis 202 (only henceforth "an axis 202") of the exhaust air bulb at the time of being installed inside by the engine cylinder head 200 in serial. Then, paying attention to the property of being dotted in serial focusing on such "an axis 201" and "an axis 202", the production system of a transfer system is performing further processing of these functional holes 201A, 201B, 201C, 202A, 202B, and 202C in consideration of productivity etc.
[0004] And in processing by the production system of this transfer system, it is performing sending out two or more rotating tools to coincidence by controlling with XZ shaft in the both sides of each station. On the other hand, in the engine cylinder head 200, as shown in drawing 15 , "the axis 201" and the "axis 202" incline and it is dotted with the functional holes 201A, 201B, and 201C for processing, and the functional holes 202A, 202B, and 202C for processing in serial in the condition of having inclined. Then, at each station, the engine cylinder head 200 is fixed to an inclination posture, and either the "axis 201" of the engine cylinder head 200 or the "axis 202" is united in the direction of a coincidence send of two or more rotating tools (Z shaft orientations) by this.
[0005] When the direction of a coincidence send of two or more rotating tools (Z shaft orientations) is specifically level and the functional holes 201A, 201B, and 201C of the circumference of "an axis 201" are processed, as shown in drawing 16 , "an axis 201" is the inclination posture which becomes level, and fixes the engine cylinder head 200. And "an axis 201" is in a condition parallel to the Z-axis on the flat surface formed with XZ shaft at this time. On the other hand, when processing the functional holes

202A, 202B, and 202C of the circumference of "an axis 202", as shown in drawing 17 , it is the inclination posture in which "an axis 202" becomes level, and the engine cylinder head 200 is fixed. And "an axis 202" is in a condition parallel to the Z-axis on the flat surface formed with XZ shaft at this time.

[0006] In addition, the inclination posture of the engine cylinder head 200 of drawing 16 after [expedient] that the following explains is called an "inspired air flow path inclination posture." Moreover, the inclination posture of the engine cylinder head 200 of drawing 17 is called a "exhaust side inclination posture." Furthermore, the posture of the engine cylinder head 200 of drawing 15 is called an "erection posture."

[0007] Next, the outline is explained for a drawing about the transfer machine of the conventional technique of processing the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 with the production system of a transfer system, making it reference. A top view shows the outline of the transfer machine 100 of the conventional technique to drawing 18 . In this transfer machine 100, the carrying-in section 102, pars intermedia 103, and the taking-out section 104 are formed on Rhine 101 where the engine cylinder head 200 is conveyed. And are prepared by a roller conveyor 108, the posture inverter 105, etc. for carrying in, and it is in the carrying-in section 102. Moreover, are prepared by the posture inverter 106 etc. and it is in pars intermedia 103. Moreover, the posture inverter 107, the roller conveyor 109 for taking out, etc. are formed in the taking-out section 104.

[0008] Furthermore, while three stations A, B, and C are formed between the carrying-in section 102 and pars intermedia 103, the fixture 110 is installed on each stations A and B and C. Similarly, while three stations E, F, and G are formed also between pars intermedia 103 and the taking-out section 104, the fixture 111 is installed on each stations E and F and G. And are prepared by the processing machine 112 and it is in the both sides of each stations A, B, C, D, E, and F.

[0009] Here, the outline of the posture inverters 105, 106, and 107 mentioned above, fixtures 110 and 111, and the processing machine 112 is explained.

[0010] First, the outline of the posture inverters 105, 106, and 107 is explained, referring to drawing 19 . Drawing 1919 is a front view having shown the outline of the posture inverter 105 prepared in the carrying-in section 102. The posture inverter 105 consists of an attaching part 121, a seating rim 122, a cylinder 123, an outer frame 124, etc. An attaching part 121 holds the engine cylinder head 200 by the rail 125 of L typeface, and the rail 126 of a rod form, and is prepared inside the seating rim 122. Moreover, the periphery carries out a radii configuration and the seating rim 122 is connected with the cylinder 123 rotatable. On the other hand, the cylinder 123 is supported by the outer frame 124 rotatable. Moreover, six guide idlers 127 to which it shows the periphery of the radii configuration of a seating rim 122 are formed in the outer frame 124.

[0011] Therefore, when the rod of a cylinder 123 is extruded or it is drawn, the periphery of a seating rim 122 will be guided at the guide idler 127 of an outer frame 124, and a seating rim 122 will rotate to the forward direction or hard flow. Consequently, the attaching part 121 prepared inside the seating rim 122 will rotate to the forward direction or hard flow similarly. It enables this to change into an "inspired air flow path inclination posture" the engine cylinder head 200 held with the "erection posture" at the attaching part 121, while it had been held at the attaching part 121. At this time, the "erection posture" and an "inspired air flow path inclination posture" of the engine cylinder head 200 held at the attaching part 121 are the limit switch (not shown) formed in the outer frame 124, and are secured by making the forward direction or hard flow of a seating rim 122 suspend rotation.

[0012] In addition, the same is said of the outline of the posture inverter 106 prepared in pars intermedia 103, and, thereby, it becomes possible [changing the engine cylinder head 200 into a "exhaust side inclination posture" from an "inspired air flow path inclination posture"]. Moreover, the same is said of the outline of the posture inverter 107 prepared in the taking-out section 104, and, thereby, it becomes possible [changing the engine cylinder head 200 into an "erection posture" from a "exhaust side inclination posture"].

[0013] Next, the outline of fixtures 110 and 111 is explained, referring to drawing 20 . Drawing 20 is the

front view having shown the outline of the fixture 110 installed in each stations A, B, and C. The fixture 110 has the adherence section 131 which insists upon the engine cylinder head 200 with an "inspired air flow path inclination posture." This adherence section 131 consists of cylinders 135 which are the rail 133 which supports and maintains the engine cylinder head 200 which carries out the plane of composition of becoming an "inspired air flow path inclination posture" to the datum plane 132 to secure and a datum plane 132 from a part of engine cylinder head 200 carrying out a plane of composition, the clamper 134 for making a datum plane 132 carry out the plane of composition of the engine cylinder head 200 by the position, and the driving source of a clamper 134. As mentioned above, since the engine cylinder head 200 upon which it insisted in the fixture 110 is in an "inspired air flow path inclination posture", the stations A, B, and C in which this fixture 110 was installed are the locations for processing the functional holes 201A, 201B, and 201C (referring to drawing 16) of the circumference of "an axis 201."

[0014] In addition, in order to make it each tool (not shown) of a machine tool 112 arrive to the engine cylinder head 200 upon which it insisted in the fixture 110, opening 136 is formed in datum level 132. moreover, the clamper 134 side with opposite datum level 132 -- clear -- illustration -- now, although it is absent, opening for making it each tool (not shown) of a machine tool 112 arrive is prepared.

[0015] On the other hand, compared with the fixture 110 (what was installed in each stations A, B, and C) of drawing 20 , since the fixture 111 (refer to drawing 18) installed in each stations E, F, and G insists upon the engine cylinder head 200 with a "exhaust side inclination posture", although it is equivalent to the datum level 132 and clamper 134, whenever [tilt-angle] etc. differ. However, about other outlines, it is the same as that of the fixture 110 (what was installed in each stations A, B, and C) of drawing 20 . As mentioned above, since the engine cylinder head 200 upon which it insisted in the fixture 111 is in a "exhaust side inclination posture", the stations E, F, and G in which this fixture 111 was installed are the locations for processing the functional holes 202A, 202B, and 202C (referring to drawing 17) of the circumference of "an axis 202."

[0016] Next, the outline of the processing machine 112 is explained, referring to drawing 2121 and drawing 22 . Drawing 21 is the front view having shown the outline of the processing machine 112 prepared in the both sides of each stations A, B, C, E, F, and G. Moreover, drawing 2222 is a sectional view cut by the Q-Q line of drawing 21 . The processing machine 112 processes the functional holes 201A, 201B, and 201C (refer to drawing 16) of the engine cylinder head 200 upon which the fixture 110 insisted with the "inspired air flow path inclination posture", or the functional holes 202A, 202B, and 202C (refer to drawing 17) of the engine cylinder head 200 upon which the fixture 111 insisted with the "exhaust side inclination posture."

[0017] Moreover, as the processing machine 112 is shown in drawing 21 , a gearbox 141, a motor 142, etc. are laid on the table 144 of XZ shaft delivery unit. And the spindle 145, the change gear style, etc. are built in the gearbox 141. Here, it has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 (refer to drawing 14), and six spindles 145 are dedicated together with the inside of a gearbox 141. And it can be made to rotate by two motors 142 through a change gear style or a driving belt 143 about six spindles 145 dedicated in the gearbox 141. Therefore, it becomes possible to rotate each tool (not shown) attached in the axis end of this spindle 145. Furthermore, each rotating tool (not shown) can be sent out to coincidence through XZ shaft delivery unit of a table 144, being controlled with XZ shaft. By these, it becomes processible by each tool (not shown) attached in the axis end of six spindles 145.

[0018] In addition, about each tool (not shown), the thing according to the magnitude of the path of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C used as the candidate for processing, the process of processing, etc. is attached to the axis end of each spindle. Moreover, XZ shaft used in case it controls with XZ shaft delivery unit of a table 144 consists of a shaft (X-axis) parallel to Rhine 101 where the engine cylinder head 200 is conveyed, and a shaft (Z-axis) parallel to the medial axis of the spindle 145 which exists in the vertical and horizontal direction to it, and was dedicated in the gearbox 141 (refer to the drawing 1818).

[0019] Next, the transfer machine 100 with such an outline explains how to process the functional holes

201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200. First, in the roller conveyor 108 of the carrying-in section 102, the engine cylinder head 200 of an "erection posture" is carried in. And the engine cylinder head 200 on a roller conveyor 108 is horizontally extruded by the cylinder which is not illustrated with an "erection posture", and is pushed on the attaching part 121 of the posture inverter 105 in it.

[0020] In the posture inverter 105, if the engine cylinder head 200 is pushed on an attaching part 121, the rod of a cylinder 123 will be made to draw and the engine cylinder head 200 held at the attaching part 121 will be changed into an "inspired air flow path inclination posture" from an "erection posture." Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 121 is caught from the bottom, is horizontally conveyed with an "inspired air flow path inclination posture", and is sent to the adherence section 131 of the fixture 110 of Station A.

[0021] When the engine cylinder head 200 of an "inspired air flow path inclination posture" is sent to the adherence section 131, extrude the rod of a cylinder 135, the engine cylinder head 200 is made to press a clamper 134, and datum level 132 is made to carry out the plane of composition of the engine cylinder head 200 by the position in the fixture 110 of Station A. And the transformer bar which is not illustrated is retreated to the bottom. Thereby, the engine cylinder head 200 is correctly fixed with an "inspired air flow path inclination posture", and the "axis 201" of the engine cylinder head 200 will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, by controlling by XZ shaft delivery unit of the table 144 of the machine tool 112 in the both sides of Station A, it sends out so that the "axis 201" top may be met. [of the engine cylinder head 200 upon which it insisted the tool (not shown) attached in the axis end of each spindle 145 dedicated in the gearbox 141, respectively in the fixture 110]

[0022] This becomes processible [the functional holes 201A, 201B, and 201C of the engine cylinder head 200 upon which it insisted in the fixture 110]. However, at Station A, functional hole 201A is roughed by one side of the machine tool 112 in the both sides, and functional hole 201C is roughed on the other hand. And since six spindles 145 dedicated in the gearbox 141 of a machine tool 112 are located in a line with pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, each tool (not shown) attached in the axis end of six spindles 145, respectively has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, and it is sent out to coincidence. Therefore, in each of six the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201A is performed to coincidence by 1 time of the send in one machine tool 112 at this time. Moreover, in each of six the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201C is similarly performed to coincidence by 1 time of the send by the machine tool 112 of another side.

[0023] However, the engine cylinder head 200 is the thing of 6-cylinder 4 bulb, and since two intake valves are installed inside to one a "combustion chamber", the two "axes 201" exists in one a "combustion chamber" (refer to drawing 14). that is, in processing mentioned above, six the "combustion chambers" established in the engine cylinder head 200 is alike, respectively, and it sets, and it is carried out about the functional holes 201A and 201C with which it is dotted in serial focusing on one the "axis 201" between the two "axes 201", and asks and comes out.

[0024] Then, processing of the functional holes 201A and 201C with which it is dotted in serial focusing on the "axis 201" of another side is performed by setting after that and controlling the tool (not shown) further attached in the axis end of the spindle 145 dedicated in the gearbox 141 by XZ shaft delivery unit of the table 144 of a machine tool 112. Therefore, at Station A, roughing of send out, namely, according to one machine tool 112 functional hole 201in one machine tool 112 A is performed twice. Similarly, roughing of send out, namely, according to machine tool 112 of another side functional hole 201C in the machine tool 112 of another side is performed twice. Thereby, at Station A, roughing is performed about all the functional hole 201A of the engine cylinder head 200, and functional hole 201C.

[0025] Thus, after processing in Station A is completed, the rod of a cylinder 135 is drawn, a clamper 134 is pulled apart from the engine cylinder head 200, and the plane of composition over the datum level 132 of the engine cylinder head 200 is made to cancel in the fixture 110 of Station A. Then, with the

transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 131 is caught from the bottom, is horizontally conveyed with an "inspired air flow path inclination posture", and is sent to the adherence section 131 of the fixture 110 of Station B.

[0026] Also at Station B, it is performed that it is the same as that of the station A mentioned above. However, the point of roughing functional hole 201B by one side of the machine tool 112 in the both sides, and roughing finish of functional hole 201B on the other hand after **** differs from the point that the engine cylinder head 200 is sent to the adherence section 131 of the fixture 110 of Station C after this processing termination. Moreover, also at Station C, it is performed that it is the same as that of the station A mentioned above. However, the point of performing finish of functional hole 201C on the other hand while finish-machining functional hole 201A by one side of the machine tool 112 in the both sides differs from the point that the engine cylinder head 200 is sent to pars intermedia 103 after this processing termination. As mentioned above, it means that processing of all the functional holes 201A, 201B, and 201C was performed in the engine cylinder head 200 sent to pars intermedia 103.

[0027] In addition, conveyance horizontally performed in the engine cylinder head 200 with the transformer bar which is not illustrated with an "inspired air flow path inclination posture" Conveyance to the fixture 110 of Station A from the posture inverter 105, conveyance to the fixture 110 of Station B of Station A from a fixture 110, Both conveyance to the fixture 110 of Station C of Station B from a fixture 110 and conveyance to pars intermedia 103 from the fixture 110 of Station C are performed by one transformer bar in synchronization.

[0028] Next, the engine cylinder head 200 sent to pars intermedia 103 is horizontally extruded even to the posture inverter 106 by the cylinder which is not illustrated with an "inspired air flow path posture." In the posture inverter 106, the engine cylinder head 200 is changed into a "exhaust side posture" from an "inspired air flow path posture." It sets after that and it is performed that it is the same as that of the case where it mentions above from the posture inverter 105 of the carrying-in section 102 to pars intermedia 103.

[0029] That is, in pars intermedia 103, the engine cylinder head 200 held at the attaching part of the posture inverter 106 is horizontally sent to the adherence section of the fixture 111 of Station D with a "exhaust side posture." Moreover, at Station D, while roughing functional hole 202A by one side of the machine tool 112 in the both sides, functional hole 202C is roughed on the other hand, and the engine cylinder head 200 is horizontally sent to the adherence section of the fixture 111 of Station E for after this processing termination with a "exhaust side posture." Moreover, at Station E, functional hole 202B is roughed by one side of the machine tool 112 in the both sides, finish of functional hole 202B is roughed on the other hand after ****, and the engine cylinder head 200 is horizontally sent to the adherence section of the fixture 111 of Station F for after this processing termination with a "exhaust side posture." Moreover, at Station F, while performing finish of functional hole 202A by one side of the machine tool 112 in the both sides, finish of functional hole 202C is performed on the other hand, and the engine cylinder head 200 is horizontally sent to the attaching part of the posture inverter 107 of the taking-out section 104 for after this processing termination with a "exhaust side posture."

[0030] As mentioned above, it means that it means that processing of all the functional holes 202A, 202B, and 202C was performed, it has, and all processings of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 were completed in the engine cylinder head 200 sent to the taking-out section 104. After that, the engine cylinder head 200 held at the attaching part of the posture inverter 107 of the taking-out section 104 is changed into an "erection posture" from a "exhaust side posture", and is horizontally extruded on a roller conveyor 109 by the cylinder which is not illustrated with an "erection posture." And it is taken out to the exterior of a transfer machine 100 by the roller conveyor 109.

[0031] In addition, since the two "axes 201" exists in each of six "combustion chambers" in the engine cylinder head 200 of 6-cylinder 4 bulb shown in drawing 14 as mentioned above, the a total of 12 "axes 201" will exist in the one engine cylinder head 200. Therefore, when the engine cylinder head 200 is in an "inspired air flow path posture", all the 12 "axes 201" will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, if it has 12 spindles 145 in the gearbox 141 of each machine

tool 112, it will set to Station A, for example. It becomes possible to make roughing of functional hole 201A by one machine tool 112 and roughing of functional hole 201C by the machine tool 112 of another side finish it as 1 time of a send, respectively. Compared with the thing of the conventional technique mentioned above which performs those processings by 2 times each of sends, it is thought that high-volume production capability increases further. However, each spacing of the 12 "axes 201" in the one engine cylinder head 200 is narrow, and it is difficult in tooth space to arrange 12 spindles 145 in all in a gearbox 141 to the 12 "axes 201." This can be said also about "an axis 202."

[0032] Namely, six spindles 145 in the gearbox 141 of each machine tool 112 Arrange with pitch spacing of six the "combustion chambers" established in the one engine cylinder head 200, and it sets to each stations A, B, C, D, E, and F. The transfer machine 100 which performs processing by the machine tool 112 of both sides by 2 times of sends, respectively and which was mentioned above It can be said that it is the production system of the transfer system which pursued high-volume production capability to the maximum extent for processing of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 of 6-cylinder 4 bulb.

[0033]

[Problem(s) to be Solved by the Invention] However, the transfer machine 100 mentioned above was difficult for the maximum production capacity to reinforce or reduce after the manufacture. Therefore, in order for this maximum production capacity to demonstrate the high-volume production capability which is the advantage of the production system of a transfer system, usually it was designed so that it could fully respond to the maximum production size expected. And to the change in a volume it is supposed that will be happened in the future, it corresponded by adjustment of the cycle time of the engine cylinder head 200 conveyed at each stations A, B, C, D, E, and F, and was carried out within the limits of the maximum production capacity set as the beginning.

[0034] Therefore, it was not extended, so that the volume expected, but when the high-volume production capability whose period which adjusted the cycle time of the engine cylinder head 200 is the advantage of the production system of a transfer system became long to extent which cannot be demonstrated effectively, conversely, the advantage of this high-volume production capability converted to the fault of superfluous capacity, and there was a possibility that the profitability of plant-and-equipment investment might get very bad. Especially Functional hole 201A of the engine cylinder heads 200, such as an automobile, In the transfer machine 100 which makes 201B, 201C, 202A, 202B, and 202C applicable to processing In the case which is as inelastic as the amount of orders received, such as an automobile, was expected, the case changed to the engine cylinder head 200 of a different class in the case of model changes, such as an automobile Since it is a certain thing plentifully that the volume of the engine cylinder head 200 falls short of anticipation, it can be said that the danger is large.

[0035] Moreover, to the change to the engine cylinder head 200 of a class which is different from the engine cylinder head 200, whenever [pitch spacing / of the "combustion chamber" of the engine cylinder head 200 / and tilt-angle / of "an axis 201" and "an axis 202"], when an appearance etc. is different, whenever [pitch spacing / of the spindle 145 of each machine tool 112 / and tilt-angle / of the datum level 132 of each fixtures 110 and 111], the location of a clamper 134, etc. must be changed in principle. however, about the location of whenever [pitch spacing / of the spindle 145 of each machine tool 112 / and tilt-angle / of the datum level 132 of each fixtures 110 and 111], or a clamper 134 Since it cannot do structurally, in order to correspond to the change to the engine cylinder head 200 of a class which is different from the engine cylinder head 200, adjusting them There was a possibility that all the machine tool 112 and all fixtures 110 and 111 might be converted sharply, an additional investment might become excessive, and the profitability of plant-and-equipment investment might get very bad. Especially Functional hole 201A of the engine cylinder heads 200, such as an automobile, In the transfer machine 100 which makes 201B, 201C, 202A, 202B, and 202C applicable to processing In the case changed to the engine cylinder head 200 of a different class in the case of model changes, such as an automobile Since it is a certain thing plentifully to change to the engine cylinder head 200 of a class which is different from the engine cylinder head 200 (only henceforth "a change of the engine cylinder head 200"), it can be said that the danger is large.

[0036] Then, this invention is made in order to solve the trouble mentioned above, and it aims at offering the transfer machine which can respond by low cost to "a change of the engine cylinder head" which is work as opposed to fluctuation of the volume of the engine cylinder head which is work.
[0037]
[Means for Solving the Problem] The transfer machine concerning claim 1 accomplished in order to attain this purpose By sending out to coincidence in XZ shaft delivery unit, rotating each tool attached in the axis end of two or more spindles arranged beside [each] the station, respectively, when the engine cylinder head is fixed on each station While processing many functional holes into coincidence by 1 time of the send to the one engine cylinder head at each station By conveying the one engine cylinder head one by one to each station While being the transfer machine which performs processing to the functional hole of the one engine cylinder head in order of each process, arranging in on said XZ shaft delivery unit the spindle head of the monopodium which dedicated only one spindle and sending out each tool to coincidence By making one spindle in each spindle head connect with one motor by coupling, and rotating each tool The change in the spindle head arranged in on said XZ shaft delivery unit is enabled, and it is characterized by the ability to change the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station.
[0038] Moreover, the transfer machine concerning claim 2 be a transfer machine indicate to claim 1, by attach housing with which said spindle head be fix in juxtaposition on said XZ shaft delivery unit, secure pitch spacing of the spindle head arrange in on said XZ shaft delivery unit, and be characterize by to secure pitch spacing of the functional hole process into coincidence by 1 time of the send to the one engine cylinder head at each station.
[0039] moreover , the transfer machine concerning claim 3 be a transfer machine indicate to claim 2 , by exchange said housing in said housing and other compatible housing , enable a setup of pitch spacing of the spindle head arrange in on said XZ shaft delivery unit , and be characterize by the ability to be able to change pitch spacing of the functional hole process into coincidence by 1 time of the send to the one engine cylinder head at each station .
[0040] Moreover, the transfer machine concerning claim 4 When the engine cylinder head is fixed with an inclination posture on each station By sending out to coincidence in XZ shaft delivery unit, rotating each tool attached in the axis end of two or more spindles arranged beside [each] the station, respectively While processing many functional holes into coincidence by 1 time of the send to the one engine cylinder head at each station By conveying the one engine cylinder head one by one to each station It is the transfer machine which performs processing to the functional hole of the one engine cylinder head in order of each process. By controlling the inclination posture of said engine cylinder head, insisting upon said engine cylinder head with the jig installed on each station It is characterized by the ability to change whenever [tilt-angle / of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station].
[0041] Moreover, the transfer machine concerning claim 5 is a transfer machine indicated to claim 4, and is characterized by the ability to change the arrangement condition of said locator pin by attaching in said jig the ROKETO member in which the locator pin for securing positioning of said engine cylinder head was prepared, and exchanging said ROKETO member to said ROKETO member and other compatible ROKETO members.
[0042] Moreover, the transfer machine concerning claim 6 is a transfer machine indicated to ******** 4 or claim 5, and is characterized by the ability to change the arrangement condition of said clamp pin by attaching in said jig the clamp member in which the clamp pin for insisting upon said engine cylinder head was prepared, and exchanging said clamp member to said clamp member and other compatible clamp members.
[0043] the monopodium (spindle) of each spindle head arranged in on XZ shaft delivery unit beside [each] a station in the transfer machine of this invention which has such a configuration -- it connects with one motor by coupling, respectively. And when the engine cylinder head which is work is fixed on each station, each tool attached in the axis end of the monopodium (spindle) of each spindle head, respectively can be rotated by rotating the monopodium (spindle) of each spindle head by each motor.

Furthermore, each tool attached in the axis end of the monopodium (spindle) of each spindle head, respectively can be sent out to coincidence by XZ shaft delivery unit. Thereby, at each station, many functional holes are processible into coincidence to the one engine cylinder head by 1 time of the send.
[0044] With the belt coupling explained in the column of the conventional technique, since connection according to the monopodium (spindle) of a spindle head and coupling of one motor at this time can be performed independently of other spindle head and other motors with that monotonous structure, it can perform easily increasing or reducing the number of each spindle heads arranged in on XZ shaft delivery unit, without large-converting. And a spindle head, a motor, coupling, etc. which were set as the object of increase and decrease can be supplied and diverted among other transfer machines. The change in the spindle head arranged in on XZ shaft delivery unit after manufacture of a transfer machine is attained by this, and the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station can be changed.
[0045] That is, if the number of the spindle heads arranged in on XZ shaft delivery unit is made to increase, since the number of the tools sent out to coincidence in XZ shaft delivery unit can be made to increase, the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station also increases.
[0046] Therefore, at a certain station, when 12 functional holes must be processed to the one engine cylinder head, [for example,] When the number of the spindle heads arranged in on XZ shaft delivery unit beside [concerned] a station is two Since the number of the tools sent out to coincidence in the XZ shaft delivery unit concerned is also two, in order to process 12 functional holes to the one engine cylinder head, it is necessary to perform the coincidence send of each tool by the XZ shaft delivery unit concerned 6 times. However, what is necessary is just to perform the coincidence send of each tool by the XZ shaft delivery unit concerned 4 times at the time of three pieces which increased the one number of the spindle heads arranged in on XZ shaft delivery unit beside [concerned] a station, in order to process 12 functional holes to the one engine cylinder head, since the number of the tools sent out to coincidence in the XZ shaft delivery unit concerned also increases to three pieces. Furthermore, what is necessary is just to perform the coincidence send of each tool by the XZ shaft delivery unit concerned twice at the time of six pieces which increased the three number of the spindle heads arranged in on XZ shaft delivery unit beside [concerned] a station, in order to process 12 functional holes to the one engine cylinder head, since the number of the tools sent out to coincidence in the XZ shaft delivery unit concerned also increases to six pieces.
[0047] Thus, if the number of the spindle heads arranged in on XZ shaft delivery unit is made to increase, since it can decrease the count of a coincidence send of each tool by XZ shaft delivery unit and time amount required for processing in each station will be shortened, the maximum production capacity of a transfer machine can be raised. Therefore, also after a transfer machine is manufactured, the maximum production capacity of a transfer machine can be reinforced by making the number of the spindle heads arranged in on XZ shaft delivery unit increase. When the maximum production size which shall be equivalent to the usual volume which it becomes impossible that it is not necessary to make the maximum production capacity of a transfer machine fully correspond [volume] to the maximum production size expected by this, and has the original maximum production capacity expected, and is expected becomes actual, it becomes possible to reinforce the original maximum production capacity.
[0048] On the contrary, if the number of the spindle heads arranged in on XZ shaft delivery unit is decreased, since the number of the tools sent out to coincidence in XZ shaft delivery unit can be decreased, the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station also decreases. Therefore, also after a transfer machine is manufactured, the maximum production capacity of a transfer machine can be made to reduce by decreasing the number of the spindle heads arranged in on XZ shaft delivery unit. In addition, it also contains that the number of the spindle heads arranged in on XZ shaft delivery unit becomes one piece here.
[0049] As mentioned above, since the original maximum production capacity can be suppressed low, it can contribute to reduction of an initial cost. Moreover, when reinforcing the maximum production

capacity after that, while a spindle head, a motor, coupling, etc. which became unnecessary with other transfer machines can be diverted, when decreasing a volume, it not only corresponds by enlarging the pitch time of the engine cylinder head conveyed at each station, but it can respond by making the maximum production capacity reduce. And when making the maximum production capacity reduce, a spindle head, a motor, coupling, etc. which became unnecessary can be made to divert to other transfer machines. Therefore, new plant-and-equipment investment hardly starts in the case of enhancement and reduction of the maximum production capacity.

[0050] Furthermore, since that to which supply, the spindle head diverted, a motor, coupling, etc. were common among other transfer machines is used in the transfer machine concerned, design costs become cheap. Moreover, since the connection structure by coupling is monotonous and there are also few component part mark, manufacture costs become cheap. Also from these viewpoints, it can contribute to reduction of an initial cost.

[0051] Moreover, in case the monopodium (spindle) of a spindle head is arranged in on XZ shaft delivery unit, it is carried out through housing attached on XZ shaft delivery unit. The location where each spindle head is fixed in juxtaposition is beforehand established in this housing at intervals of the predetermined pitch, and it makes it still easier to fluctuate the spindle head arranged in on XZ shaft delivery unit free. Thereby, pitch spacing of the spindle head arranged in on XZ shaft delivery unit is secured, and security of pitch spacing of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station is made.

[0052] Therefore, by exchanging housing attached on XZ shaft delivery unit in other housing with which the values of pitch spacing differ, a setup of pitch spacing of the spindle head arranged in on XZ shaft delivery unit can be enabled, it has, and it becomes possible to change pitch spacing of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station.

[0053] When two or more especially functional holes of the engine cylinder head are usually prepared at equal intervals by the engine Taki cylinder-ization and it changes to the engine cylinder head of the class from which, as for this pitch spacing, the engine cylinder head differs since it is different with the class of engine cylinder head in many cases, modification of pitch spacing of the monopodium (spindle) of a spindle head is needed in many cases. And without converting sharply modification of pitch spacing of the monopodium (spindle) of a spindle head at this time, since it can do only by exchanging housing, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.

[0054] Moreover, the jig installed on each station can control the inclination posture freely, insisting upon the engine cylinder head. Therefore, whenever [tilt-angle / of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station] can be changed.

[0055] Especially the functional hole of the engine cylinder head has many which are inclined and prepared in order to secure the function, and whenever [this tilt-angle] needs modification of the inclination posture of the engine cylinder head in many cases, when changing to the engine cylinder head of the class from which the engine cylinder head differs, since it is usually different with the class of engine cylinder head. And since it can do only in control by the fixture, without modification of the inclination posture of the engine cylinder head converting a fixture sharply at this time, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.

[0056] Moreover, when the functional holes for processing differ even if it is the same engine cylinder head since whenever [tilt-angle / of the engine cylinder head] is different in many cases not only between the engine cylinder heads of a different class but within the one engine cylinder head, modification of the inclination posture of the engine cylinder head is needed in many cases. And since modification of the inclination posture of the engine cylinder head does not prepare the fixture of dedication for every different inclination posture but is possible only in control by the common fixture at each station at this time, design costs become cheap by communalization of a fixture, and it can contribute to reduction of an initial cost.

[0057] Moreover, in the jig installed on each station, in case it insists upon the engine cylinder head, positioning of the engine cylinder head is secured with the locator pin prepared in the ROKETO member. And in this ROKETO member, arrangement conditions, such as a location of a locator pin and die length, are determined so that it may correspond to the locating hole prepared in the engine cylinder head. Therefore, the arrangement condition of a locator pin can be changed by exchanging the ROKETO member attached in a fixture to other ROKETO members from which the arrangement condition of a locator pin differs.
[0058] Since the shape especially of surface type of the engine cylinder head is different with the class of engine cylinder head in many cases, in changing to the engine cylinder head of the class from which the engine cylinder head differs, the location of a locating hole established in the engine cylinder head is obliged to modification in many cases, and needs modification of the arrangement condition of a locator pin in many cases. And without modification of the arrangement condition of a locator pin converting a fixture sharply at this time, since it can do only by exchanging a ROKETO member, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.
[0059] Moreover, in the jig installed on each station, in case it insists upon the engine cylinder head, it is insisting upon the engine cylinder head by the clamp pin prepared in clamp material. And in this clamp member, arrangement conditions, such as a location of a clamp pin and die length, are determined in consideration of the part by which a pressure welding is carried out to the engine cylinder head. Therefore, the arrangement condition of a clamp pin can be changed by exchanging the clamp member attached in a fixture to other clamp members from which the arrangement condition of a clamp pin differs.
[0060] Since the shape especially of surface type of the engine cylinder head is different with the class of engine cylinder head in many cases, in changing to the engine cylinder head of the class from which the engine cylinder head differs, the part by which a pressure welding is carried out to the engine cylinder head is obliged to modification in many cases, and needs modification of the arrangement condition of a clamp pin in many cases. And without modification of the arrangement condition of a clamp pin converting a fixture sharply at this time, since it can do only by exchanging a clamp member, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.
[0061] namely, in the transfer machine of this invention Since the change in the spindle head arranged in on XZ shaft delivery unit was enabled, enhancement and reduction of the maximum production capacity are attained after the manufacture and the original maximum production capacity can be suppressed low Since it can contribute to reduction of an initial cost and a spindle head, a motor, coupling, etc. can be diverted, while design costs are cheap and end Since new plant-and-equipment investment does not almost have this thing in the case of enhancement and reduction of the maximum production capacity, and the connection structure of a spindle head or a motor is monotonous, and the manufacture costs are also cheap and can finish it further It can respond by low cost to fluctuation of the volume of the engine cylinder head which is work.
[0062] By moreover, exchange of housing, control by the fixture, exchange of a ROKETO member, and exchange of a clamp member Modification of pitch spacing of the functional hole of the engine cylinder head, modification of whenever [tilt-angle / of the functional hole of the engine cylinder head], Since it can respond to modification of the location of the locating hole of the engine cylinder head, and modification of the pressure-welding part of the clamp pin to the engine cylinder head and an excessive additional investment is not needed in that case It can respond by low cost to "a change of the engine cylinder head" which is work.
[0063] Moreover, it sets to the jig installed on each station. It becomes possible to make the posture of the engine cylinder head at the time of adherence by the fixture being canceled communalize at all stations, since the inclination posture of the engine cylinder head is freely controllable. By this Since the posture of the engine cylinder head at the time of conveyance to each station and taking out can also be made to communalize It becomes possible to lose a part or all among three posture transfer devices

stated in the column of the conventional technique, and an initial cost can be low held down also from this viewpoint.
[0064] moreover, the time amount which the change in a spindle head, exchange of housing, exchange of a ROKETO member, and exchange of a clamp member take is markedly boiled compared with the time amount which large reconstruction of the conventional technique takes, since it is short, can prevent the shutdown of production over a long period of time, and can make profitability of plant-and-equipment investment high also from this viewpoint.
[0065]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is made reference and a drawing is explained. The transfer machine of the gestalt of this operation processes the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 of drawing 14 with the production system of a transfer system as well as the transfer machine 100 explained in the column of the conventional technique.
[0066] A top view shows the transfer machine 1 of the gestalt of this operation to drawing 1 . In order that the transfer machine 1 of the gestalt of this operation may clarify a difference with the transfer machine 100 explained in the column of the conventional technique, it is based on the layout of the transfer machine 100 of the conventional technique shown in drawing 18 , and the same sign used in the column of the conventional technique is used for it about what [common].
[0067] That is, in the transfer machine 1 of the gestalt of this operation, the carrying-in section 102 and the taking-out section 104 are formed on Rhine 101 where the engine cylinder head 200 is conveyed. And are prepared by a roller conveyor 108, the posture inverter 15, etc. for carrying in, and it is in the carrying-in section 102. Moreover, the posture inverter 17, the roller conveyor 109 for taking out, etc. are formed in the taking-out section 104.
[0068] Furthermore, while six stations A, B, C, D, E, and F are formed between the carrying-in section 102 and the taking-out section 104, the fixture 10 is installed on each stations A, B, C, D, and E and F. And are prepared by the processing machine 12 and it is in the both sides of each stations A, B, C, D, E, and F.
[0069] Here, the outline of the posture inverters 15 and 17 mentioned above, a fixture 10, and the processing machine 12 is explained.
[0070] First, the outline of the posture inverters 15 and 17 is explained. The posture inverter 15 is the same as the posture inverter 105 explained in the column of the conventional technique about the outline, although it differs in that the engine cylinder head 200 held with the "erection posture" as compared with the posture inverter 105 explained in the column of the conventional technique is changed into the posture (henceforth a "horizontal standing position") shown in drawing 13 . Moreover, the posture inverter 17 is the same as the posture inverter 107 explained in the column of the conventional technique about the outline, although it differs in that the engine cylinder head 200 held with the "horizontal standing position" shown in drawing 13 as compared with the posture inverter 107 explained in the column of the conventional technique is changed into an "erection posture."
[0071] That is, since both of the posture inverters 15 and 17 are common about the point of changing the posture of the engine cylinder head 200 between an "erection posture" and a "horizontal standing position", the structure is completely the same, and it is installed in the carrying-in section 102 and the taking-out section 104 so that each other may be made to face. If it carries out from this viewpoint, it is communalized, and design costs become cheap and both of the posture inverters 15 and 17 can call it what contributes to reduction of an initial cost.
[0072] Next, the outline of a fixture 10 is explained, referring to drawing 2 - drawing 9. Drawing 2 is the front view of a fixture 10. Moreover, drawing 3 is the rear view of a fixture 10. Moreover, drawing 4 is the top view having shown the datum level 32 of the body 25 of a fixture 10. Moreover, drawing 5 and drawing 6 are the sectional views having shown the outline of the drive system of the ROKETO member 49 of a fixture 10. Moreover, drawing 7 is the side elevation of a fixture 10.
[0073] Moreover, in order to make an understanding of a fixture 10 easy, while the perspective view which looked at the fixture 10 from the transverse-plane side is shown in drawing 8 , the perspective

view which looked at the fixture 10 from the tooth-back side is shown in drawing 9 . However, the fixture 10 shown in drawing 8 and drawing 9 is another thing to the engine cylinder head of 4-cylinder 4 bulb which does not receive the engine cylinder head 200 of 6-cylinder 4 bulb of drawing 14 , and is not illustrated. Therefore, between the fixture 10 shown in drawing 7 from drawing 2 , and the fixture 10 shown in drawing 8 and drawing 9 , the configurations of the components which correspond mutually may differ or corresponding components may not exist. In addition, about the components which correspond mutually, the same sign is used here from a viewpoint which makes an understanding of a fixture 10 easy.

[0074] And the fixture 10 installed in each stations A, B, C, D, E, and F has the adherence section 31 which insists upon the engine cylinder head 200, as shown in drawing 7 . This adherence section 31 is sent out while an engine cylinder 200 is sent with a "horizontal standing position", and it consists of a clamper 34 which is a clamp member for making a datum plane 32 carry out the plane of composition of the rail 33 and the engine cylinder head 200 of the rod type which supports and maintains the engine cylinder head 200 which carries out a plane of composition at the datum plane 32 as for which a part of engine cylinder head 200 carries out a plane of composition, and a datum plane 32, a cylinder 35 which is the driving source of a clamper 34.

[0075] In addition, as it is shown in drawing 3 in order to make it each tool (not shown) of a machine tool 12 arrive to the engine cylinder head 200 upon which it insisted in the fixture 10 for example, opening 37 is formed in datum level 32. Moreover, as shown in drawing 2 , the opening 36 for making it each tool (not shown) of a machine tool 12 arrive is formed also in the clamper 34 side with opposite datum level 32. Moreover, as shown in drawing 7 , two rails 22 of the rod type which contacts the engine cylinder head 200 of the opposite side, and the rail 23 of a rod form which supports and maintains the engine cylinder head 200 are formed in the clamper 34 side in the datum plane 32. However, in the jig 10 of drawing 8 and drawing 9 , the rail 24 of a rod form which contacts the near engine cylinder head 200 of a datum plane 32 by the datum-plane 32 side is formed. Moreover, the rails 23 and 33 which support and maintain the engine cylinder head 200 are not the configurations of a rod form.

[0076] And for example, as shown in drawing 2 , the body 25 which has the attaching part 31 mentioned above is supported to revolve with the bearing 26 in which the both sides were prepared by the stand 27. Moreover, above the stand 27, the driving cylinder 30 which extrudes with a servo motor 29 or is made to draw supports the ball screw 28 rotatable through the support section 41. Furthermore, the tip 42 of the ball screw 28 of a driving cylinder 30 is connected with the side face of a body 25 rotatable.

[0077] Therefore, in a driving cylinder 30, as shown in drawing 7 , if a ball screw 28 is made to draw with a servo motor 29, a body 25 will rotate clockwise and will incline. And when the part leans a body 25 even to the body 46 shown with the two-dot chain line, the engine cylinder 200 of a "horizontal standing position" can be made into an "inspired air flow path inclination posture." In addition, the driving cylinder 30 at this time is clockwise rotated focusing on the support section 41, and that center line 43 inclines even to a center line 44. Moreover, if the reverse is made to extrude a ball screw 28 with a servo motor 29, a body 25 will rotate counterclockwise and will incline. And when the part leans a body 25 even to the body 47 shown with the two-dot chain line, the engine cylinder 200 of a "horizontal standing position" can be made into a "exhaust side inclination posture." In addition, the driving cylinder 30 at this time is counterclockwise rotated focusing on the support section 41, and that center line 43 inclines even to a center line 45.

[0078] Moreover, for example, as shown in drawing 4 , six outlets 48 are formed in the datum-level 32 side of a body 25. Coolant liquid and the compressed air for washing blow off from these outlets 48. In addition, the coolant liquid for washing removes the swarf adhering to the engine cylinder head 200 etc., and it is being used for it in order to make datum level 32 carry out the plane of composition of the engine cylinder head 200 certainly. Moreover, the compressed air is used for judging extent of the plane of composition of the engine cylinder head 200 to a datum plane 32 according to the leakage condition from an outlet 48.

[0079] Moreover, for example, as shown in drawing 4 , the ROKETO member 49 with a locator pin 50

is formed in the inner both sides of a body 25. And as shown in drawing 5 and drawing 6 which are the fragmentary sectional view cut by the R-R line of drawing 4 , the ROKETO member 49 is extruded or (refer to drawing 5) drawn by the cylinder 51, showing around at two axial pins 52 (refer to drawing 6). Thereby, it can be made to insert [locator pin / 50 / of the ROKETO member 49] to the locating hole (not shown) of the engine cylinder 200 of an attaching part 31. In addition, in the jig 10 of drawing 8 and drawing 9 , the ROKETO member 49 of a different configuration is used and it is in the arrangement (a location, die length, etc.) from which the locator pin 50 of this ROKETO member 49 also differs.

[0080] Next, the outline of the processing machine 12 is explained, referring to drawing 10 R> 0, drawing 11 , and drawing 12 . Drawing 10 is the front view having shown the outline of the processing machine 12 prepared in the both sides of each stations A, B, C, E, F, and G from the Z-axis. Moreover, drawing 11 is the front view having shown the outline of the processing machine 12 prepared in the both sides of each stations A, B, C, E, F, and G from the X-axis. Furthermore, drawing 12 is the fragmentary sectional view which cut only housing 62 by the S-S line of drawing 10 . The processing machine 12 processes the functional holes 201A, 201B, and 201C of the engine cylinder head 200 upon which the fixture 10 insisted with the "inspired air flow path inclination posture", or the functional holes 202A, 202B, and 202C of the engine cylinder head 200 upon which the fixture 11 insisted with the "exhaust side inclination posture."

[0081] Moreover, by the processing machine 12, as shown in drawing 10 and drawing 11 , the spindle head 63 and the motor 64 are being fixed in the housing 62 attached on XZ shaft delivery unit 61. In this housing 62, it has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 (refer to drawing 14), and two spindle heads 63 and two motors 64 are being fixed. Moreover, one spindle 66 (refer to drawing 12) is dedicated to the interior of a spindle head 63. Furthermore, as shown in drawing 12 , within housing 62, the spindle 66 of a spindle head 63 is connected with the motor 64 by coupling 65.

[0082] Therefore, it can be made to rotate by one motor 64 through coupling 65 about one spindle 66 dedicated in the spindle head 63. Therefore, it becomes possible to rotate each tool (not shown) attached in the axis end of this spindle 66. Furthermore, each rotating tool (not shown) can be sent out to coincidence through XZ shaft delivery unit 61, being controlled with XZ shaft. By these, it becomes processible by each tool (not shown) attached in the axis end of a spindle 66. In addition, about each tool (not shown), the thing according to the magnitude of the path of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C used as the candidate for processing, the process of processing, etc. is attached to the axis end of each spindle 66.

[0083] Next, the transfer machine 1 with such an outline explains how to process the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200. First, in the roller conveyor 108 of the carrying-in section 102, the engine cylinder head 200 of an "erection posture" is carried in. And the engine cylinder head 200 on a roller conveyor 108 is horizontally extruded by the cylinder which is not illustrated with an "erection posture", and is pushed on the attaching part of the posture inverter 15 in it.

[0084] With the posture inverter 15, if the engine cylinder head 200 is pushed on an attaching part, the engine cylinder head 200 held at the attaching part will be changed into a "horizontal standing position" from an "erection posture" by the same mechanism as the posture inverter 105 explained in the column of the conventional technique. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part is caught from the bottom, is horizontally conveyed with a "horizontal standing position", and is sent to the adherence section 31 of the fixture 10 of Station A.

[0085] When the engine cylinder head 200 of a "horizontal standing position" is sent to the adherence section 31, extrude the rod of a cylinder 35, the engine cylinder head 200 is made to press the clamp pin 21 of a clamper 34, and datum level 32 is made to carry out the plane of composition of a part of engine cylinder head 200 in the fixture 10 of Station A. Extrude the rod of a cylinder 51 to coincidence, it is made to insert the locator pin 50 of the ROKETO member 49 in the locating hole (not shown) of the engine cylinder head 200, and datum level 32 is made to carry out the plane of composition of the

engine cylinder head 200 to it by the position. And the transformer bar which is not illustrated is retreated to the bottom. Thereby, the engine cylinder head 200 is correctly fixed with a "horizontal standing position."
[0086] Furthermore, in a driving cylinder 30, the engine cylinder 200 of a "horizontal standing position" is made into an "inspired air flow path inclination posture" by making a ball screw 28 draw with a servo motor 29. Thereby, the engine cylinder head 200 is correctly fixed with an "inspired air flow path inclination posture", and the "axis 201" of the engine cylinder head 200 will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, by controlling by XZ shaft delivery unit 61 of the machine tool 12 in the both sides of Station A, it sends out so that the "axis 201" top may be met.
[of the engine cylinder head 200 upon which it insisted the tool (not shown) attached in the axis end of the spindle 66 dedicated in the spindle head 63 in the fixture 10]
 [0087] This becomes processible [the functional holes 201A, 201B, and 201C of the engine cylinder head 200 upon which it insisted in the fixture 10]. However, at Station A, functional hole 201A is roughed by one side of the machine tool 12 in the both sides, and functional hole 201C is roughed on the other hand. And two spindles 66 which two spindle heads 63 were fixed to the housing 62 of a machine tool 12, and were dedicated in these spindle heads 63, respectively From having stood in a line with pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 Each tool (not shown) attached in the axis end of two spindles 66, respectively has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, and is sent out to coincidence. Therefore, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201A is performed to coincidence by 1 time of the send in one machine tool 12 at this time. Moreover, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201C is similarly performed to coincidence by 1 time of the send by the machine tool 12 of another side.
[0088] However, the engine cylinder head 200 is the thing of 6-cylinder 4 bulb, and since two intake valves are installed inside to one a "combustion chamber", the two "axes 201" exists in one a "combustion chamber" (refer to drawing 14). That is, the 12 "axes 201" will exist in the one engine cylinder head 200 which has six "combustion chambers." On the other hand in processing mentioned above, it is carried out in the one engine cylinder head 200 about the functional holes 201A and 201C with which it is dotted in serial focusing on the two "axes 201" among the 12 "axes 201", and is a request.
[0089] Then, processing of the functional holes 201A and 201C with which it is dotted in serial focusing on the remaining "axis 201" is performed by setting after that and controlling the tool (not shown) further attached in the axis end of the spindle 66 dedicated in the spindle head 63 by XZ shaft delivery unit 61 of a machine tool 12. Therefore, at Station A, roughing of send out, namely, according to one machine tool 112 functional hole 201in one machine tool 12 A is performed 6 times. Similarly, roughing of send out, namely, according to machine tool 12 of another side functional hole 201C in the machine tool 12 of another side is performed 6 times. Thereby, at Station A, roughing is performed about all the functional hole 201A of the engine cylinder head 200, and functional hole 201C.
[0090] Thus, termination of processing in Station A returns the engine cylinder 200 of an "inspired air flow path inclination posture" to a "horizontal standing position" by making a ball screw 28 extrude with a servo motor 29 in a driving cylinder 30 in the fixture 10 of Station A. And the rod of a cylinder 35 is drawn and the clamp pin 21 of a clamper 34 is pulled apart from the engine cylinder head 200. The rod of a cylinder 51 is drawn in coincidence and the locator pin 50 of the ROKETO member 49 is removed from the locating hole (not shown) of the engine cylinder head 200. Thereby, the plane of composition over the datum level 32 of the engine cylinder head 200 can be made to cancel. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 31 is caught from the bottom, is horizontally conveyed with a "horizontal standing position", and is sent to the adherence section 31 of the fixture 10 of Station B.
[0091] Also at Station B, it is performed that it is the same as that of the station A mentioned above. However, the point of roughing functional hole 201B by one side of the machine tool 12 in the both

sides, and roughing finish of functional hole 201B on the other hand after **** differs from the point that the engine cylinder head 200 is sent to the adherence section 31 of the fixture 10 of Station C after this processing termination. Moreover, also at Station C, it is performed that it is the same as that of the station A mentioned above. However, the point of performing finish of functional hole 201C on the other hand while finish-machining functional hole 201A by one side of the machine tool 12 in the both sides differs from the point that the engine cylinder head 200 is sent to the adherence section 31 of the fixture 10 of Station D after this processing termination. As mentioned above, it means that processing of all the functional holes 201A, 201B, and 201C was performed in the engine cylinder head 200 sent to the adherence section 31 of the fixture 10 of Station D.

[0092] Next, when the engine cylinder head 200 of a "horizontal standing position" is sent to the adherence section 31, extrude the rod of a cylinder 35, the engine cylinder head 200 is made to press the clamp pin 21 of a clamper 34, and datum level 32 is made to carry out the plane of composition of a part of engine cylinder head 200 in the fixture 10 of Station D. Extrude the rod of a cylinder 51 to coincidence, it is made to insert the locator pin 50 of the ROKETO member 49 in the locating hole (not shown) of the engine cylinder head 200, and datum level 32 is made to carry out the plane of composition of the engine cylinder head 200 to it by the position. And the transformer bar which is not illustrated is retreated to the bottom. Thereby, the engine cylinder head 200 is correctly fixed with a "horizontal standing position."

[0093] Furthermore, in a driving cylinder 30, the engine cylinder 200 of a "horizontal standing position" is made into a "exhaust side inclination posture" by making a ball screw 28 extrude with a servo motor 29. Thereby, the engine cylinder head 200 is correctly fixed with a "exhaust side inclination posture", and the "axis 202" of the engine cylinder head 200 will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, by controlling by XZ shaft delivery unit 61 of the machine tool 12 in the both sides of Station D, it sends out so that the "axis 202" top may be met. [of the engine cylinder head 200 upon which it insisted the tool (not shown) attached in the axis end of the spindle 66 dedicated in the spindle head 63 in the fixture 10]

[0094] This becomes processible [the functional holes 202A, 202B, and 202C of the engine cylinder head 200 upon which it insisted in the fixture 10]. However, at Station D, functional hole 202A is roughed by one side of the machine tool 12 in the both sides, and functional hole 202C is roughed on the other hand. And two spindles 66 which two spindle heads 63 were fixed to the housing 62 of a machine tool 12, and were dedicated in these spindle heads 63, respectively From having stood in a line with pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 Each tool (not shown) attached in the axis end of two spindles 66, respectively has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, and is sent out to coincidence. Therefore, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 202A is performed to coincidence by 1 time of the send in one machine tool 12 at this time. Moreover, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 202C is similarly performed to coincidence by 1 time of the send by the machine tool 12 of another side.

[0095] However, the engine cylinder head 200 is the thing of 6-cylinder 4 bulb, and since two exhaust air bulbs are installed inside to one a "combustion chamber", the two "axes 202" exists in one a "combustion chamber" (refer to drawing 14). That is, the 12 "axes 202" will exist in the one engine cylinder head 200 which has six "combustion chambers." On the other hand in processing mentioned above, it is carried out in the one engine cylinder head 200 about the functional holes 202A and 202C with which it is dotted in serial focusing on the two "axes 202" among the 12 "axes 202", and is a request.

[0096] Then, processing of the functional holes 202A and 202C with which it is dotted in serial focusing on the remaining "axis 202" is performed by setting after that and controlling the tool (not shown) further attached in the axis end of the spindle 66 dedicated in the spindle head 63 by XZ shaft delivery unit 61 of a machine tool 12. Therefore, at Station D, roughing of send out, namely, according to one machine tool 112 functional hole 202in one machine tool 12 A is performed 6 times. Similarly, roughing

of send out, namely, according to machine tool 12 of another side functional hole 202C in the machine tool 12 of another side is performed 6 times. Thereby, at Station D, roughing is performed about all the functional hole 202A of the engine cylinder head 200, and functional hole 202C.
[0097] Thus, termination of processing in Station D makes the engine cylinder 200 of a "exhaust side inclination posture" a "horizontal standing position" by making a ball screw 28 draw with a servo motor 29 in a driving cylinder 30 in the fixture 10 of Station D. And the rod of a cylinder 35 is drawn and the clamp pin 21 of a clamper 34 is pulled apart from the engine cylinder head 200. The rod of a cylinder 51 is drawn in coincidence and the locator pin 50 of the ROKETO member 49 is removed from the locating hole (not shown) of the engine cylinder head 200. Thereby, the plane of composition over the datum level 32 of the engine cylinder head 200 can be made to cancel. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 31 is caught from the bottom, is horizontally conveyed with a "horizontal standing position", and is sent to the adherence section 31 of the fixture 10 of Station E.
[0098] Also at Station E, it is performed that it is the same as that of the station D mentioned above. However, the point of roughing functional hole 202B by one side of the machine tool 12 in the both sides, and roughing finish of functional hole 202B on the other hand after **** differs from the point that the engine cylinder head 200 is sent to the adherence section 31 of the fixture 10 of Station F after this processing termination. Moreover, also at Station F, it is performed that it is the same as that of the station D mentioned above. However, the point of performing finish of functional hole 202C on the other hand while finish-machining functional hole 202A by one side of the machine tool 12 in the both sides differs from the point that the engine cylinder head 200 is sent to the attaching part of the posture inverter 17 of the taking-out section 104 after this processing termination.
[0099] In addition, conveyance horizontally performed in the engine cylinder head 200 with the transformer bar which is not illustrated with a "horizontal standing position" Conveyance to the fixture 10 of Station A from the posture inverter 15, conveyance to the fixture 10 of Station B of Station A from a fixture 10, Conveyance to the fixture 10 of Station C of Station B from a fixture 10, Conveyance to the fixture 10 of Station D of Station C from a fixture 10, Conveyance to the fixture 10 of Station E of Station D from a fixture 10, Both conveyance to the fixture 10 of Station F of Station E from a fixture 10 and conveyance to the posture inverter 17 of the taking-out section 104 from the fixture 10 of Station F are performed by one transformer bar in synchronization.
[0100] As mentioned above, it means that it means that processing of all the functional holes 202A, 202B, and 202C was performed, it has, and all processings of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 were completed in the engine cylinder head 200 sent to the taking-out section 104. After that, the engine cylinder head 200 held at the attaching part of the posture inverter 17 of the taking-out section 104 is the same mechanism as the posture inverter 107 explained in the column of the conventional technique, is changed into an "erection posture" from a "horizontal standing position", and is horizontally extruded on a roller conveyor 109 by the cylinder which is not illustrated with an "erection posture." And it is taken out to the exterior of a transfer machine 1 by the roller conveyor 109.
[0101] In addition, if "the axis 201" and "an axis 202" of the engine cylinder head 200 are compared as shown in drawing 7 , "an axis 201" will be in a condition parallel to the Z-axis in a location higher than "an axis 202" on the flat surface formed with XZ shaft. Then, with the machine tool 12, in order to lose the effect of this difference, as shown in drawing 10 and drawing 11 , the plate 70 is ****(ed) between XZ shaft delivery unit 61 and housing 62. That is, adjustment is performed with the thickness of a plate 70.
[0102] the monopodium (spindle 66) of two spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 of those width at each stations A, B, C, D, E, and F in the transfer machine 1 of the gestalt of this operation as explained to the detail above -- it connects with one motor 64 by coupling 65, respectively (refer to drawing 12). And when the engine cylinder head 200 which is work is fixed with a fixture 10 on each stations A, B, C, D, and E and F, each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively can be rotated by rotating the

monopodium (spindle 66) of each spindle head 63 by each motor 64. Furthermore, each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively can be sent out to coincidence by XZ shaft delivery unit 61.

[0103] Thereby, at Station A, it is 1 time of a send and two roughing of functional hole 201A or two functional hole 201C can be roughed to the one engine cylinder head 200 at coincidence. Moreover, at Station B, it is 1 time of a send and two roughing of functional hole 201B or two finish of functional hole 201B can be performed to coincidence to the one engine cylinder head 200. Moreover, at Station C, it is 1 time of a send and two finish of functional hole 201A or finish of two functional hole 201C can be performed to coincidence to the one engine cylinder head 200.

[0104] Moreover, at Station D, it is 1 time of a send and two roughing of functional hole 202A or two functional hole 202C can be roughed to the one engine cylinder head 200 at coincidence. Moreover, at Station E, it is 1 time of a send and two roughing of functional hole 202B or two finish of functional hole 202B can be performed to coincidence to the one engine cylinder head 200. Moreover, at Station F, it is 1 time of a send and two finish of functional hole 202A or finish of two functional hole 202C can be performed to coincidence to the one engine cylinder head 200.

[0105] At this time, to the monopodium (spindle 66) of a spindle head 63, and coupling of one motor 64, 65 the connection to depend From the belt coupling explained in the column of the conventional technique being what can be performed independently of other spindle head 63 and other motors 64 with the monotonous structure (refer to drawing 21) It can perform easily increasing or reducing the number of each spindle heads 63 put in order by XZ shaft delivery unit top 61, without large-converting. And the spindle head 63 and motor 64 which were set as the object of increase and decrease, and coupling 65 grade can be supplied and diverted among other transfer machines 1. The change in the spindle head 63 arranged in on XZ shaft delivery unit 61 after manufacture of a transfer machine 1 is attained by this, and it sets to each stations A, B, C, D, E, and F. The number of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C processed into coincidence by 1 time of the send can be changed to the one engine cylinder head 200.

[0106] Namely, if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 is made to increase, since the number of the tools (not shown) sent out to coincidence in XZ shaft delivery unit 61 can be made to increase At each stations A, B, C, D, E, and F, the number of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C processed into coincidence by 1 time of the send also increases to the one engine cylinder head 200.

[0107] Therefore, it sets like the gestalt of this operation to the machine tool 12 of one side of each stations A, B, C, D, E, and F. To the one engine cylinder head 200 by the case where 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) must be processed When the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 concerned is two Since the number of the tools (not shown) sent out to coincidence in the XZ shaft delivery unit 61 concerned is also two In order to process 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) to the one engine cylinder head 200, it is necessary to perform the coincidence send of each tool (not shown) by the XZ shaft delivery unit 61 concerned 6 times.

[0108] however, at the time of three pieces which increased the one number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 concerned, for example Since the number of the tools (not shown) sent out to coincidence in the XZ shaft delivery unit 61 concerned also increases to three pieces What is necessary is just to perform the coincidence send of each tool (not shown) by the XZ shaft delivery unit 61 concerned 4 times, in order to process 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) to the one engine cylinder head 200. furthermore, at the time of six pieces which increased the three number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 concerned Since the number of the tools (not shown) sent out to coincidence in the XZ shaft delivery unit 61 concerned also increases to six pieces What is necessary is just to perform the coincidence send of each tool (not shown) by the XZ shaft delivery unit 61 concerned twice, in order to process 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) to the one engine cylinder head 200.

[0109] Thus, if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 is made to increase, since it can decrease the count of a coincidence send of each tool (not shown) by XZ shaft delivery unit 61 and time amount required for processing in each stations A, B, C, D, E, and F will be shortened, the maximum production capacity of a transfer machine 1 can be raised. Therefore, also after a transfer machine 1 is manufactured, the maximum production capacity of a transfer machine 1 can be reinforced by making the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 increase. When the maximum production size which shall be equivalent to the usual volume which it becomes impossible that it is not necessary to make the maximum production capacity of a transfer machine 1 fully correspond [volume] to the maximum production size expected by this, and has the original maximum production capacity expected, and is expected becomes actual, it becomes possible to reinforce the original maximum production capacity.

[0110] On the contrary, if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 is decreased, since the number of the tools (not shown) sent out to coincidence in XZ shaft delivery unit 61 can be decreased At each stations A, B, C, D, E, and F, the number of the functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) processed into coincidence by 1 time of the send also decreases to the one engine cylinder head 200. Therefore, also after a transfer machine 1 is manufactured, the maximum production capacity of a transfer machine 1 can be made to reduce by decreasing the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61. In addition, the same effectiveness can be demonstrated even if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 becomes one piece.

[0111] As mentioned above, since the original maximum production capacity can be suppressed low, it can contribute to reduction of an initial cost. Moreover, when reinforcing the maximum production capacity after that, while a spindle head 63, a motor 64, coupling 65, etc. which became unnecessary with other transfer machines 1 can be diverted, when decreasing a volume, it not only corresponds by enlarging the pitch time of the engine cylinder head 200 conveyed at each stations A, B, C, D, E, and F, but it can respond by making the maximum production capacity reduce. And when making the maximum production capacity reduce, a spindle head 63, a motor 64, coupling 65, etc. which became unnecessary can be made to divert to other transfer machines 1. Therefore, new plant-and-equipment investment hardly starts in the case of enhancement and reduction of the maximum production capacity.

[0112] Furthermore, since that to which supply, the spindle head 63 diverted, a motor 64, coupling 65, etc. were common among other transfer machines 1 is used in the transfer machine 1 concerned, design costs become cheap. Moreover, since the connection structure by coupling 65 is monotonous and there are also few component part mark, manufacture costs become cheap. Also from these viewpoints, it can contribute to reduction of an initial cost.

[0113] Moreover, as shown in drawing 10 or drawing 12 , in case the monopodium (spindle 66) of a spindle head 63 is arranged in on XZ shaft delivery unit 61, it is carried out through the housing 62 attached on XZ shaft delivery unit 61. The location where two spindle heads 63 are fixed in juxtaposition is beforehand established in this housing 62 at intervals of the predetermined pitch (pitch spacing of six the "combustion chambers" established in the engine cylinder head 200), and it makes it still easier to fluctuate the spindle head 63 arranged in on XZ shaft delivery unit 61 free. In addition, when making the number of these spindle heads 63 into three or more pieces, housing 62 is exchanged to what can fix three or more spindle heads 63. Pitch spacing (pitch spacing of six the "combustion chambers" established in the engine cylinder head 200) of the spindle head 63 arranged in on XZ shaft delivery unit 61 is secured by this, and it sets to each stations A, B, C, D, E, and F. the functional hole (201A --) processed into coincidence by 1 time of the send to the one engine cylinder head 200 Security of those pitch spacing (pitch spacing of six the "combustion chambers" established in the engine cylinder head 200) is made about any one of 201B, 201C, 202A, 202B, and the 202C.

[0114] Therefore, by exchanging the housing 62 attached on XZ shaft delivery unit 61 in other housing 62 with which the values of pitch spacing differ Can enable a setup of pitch spacing of the spindle head 63 arranged in on XZ shaft delivery unit 61, have, and it sets to each stations A, B, C, D, E, and F. It becomes possible to the one engine cylinder head 200 to change those pitch spacing about the functional

hole (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) processed into coincidence by 1 time of the send.
[0115] Especially the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 Usually by the engine Taki cylinder-ization, more than one are prepared at equal intervals. This pitch spacing Since it is different with the class of engine cylinder head 200 in many cases, in changing to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, it needs modification of pitch spacing of the monopodium (spindle 66) of a spindle head 63 in many cases. And without converting sharply modification of pitch spacing of the monopodium (spindle 66) of a spindle head 63 at this time, since it can do only by exchanging housing 62, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.
[0116] Moreover, each stations A, B, C, D, and E and the jig 10 installed on F can control the inclination posture freely, insisting upon the engine cylinder head 200 (refer to drawing 7). Therefore, at each stations A, B, C, D, E, and F, whenever [tilt-angle / of the functional hole (any one of 201A, 201B 201C 202A, 202B, and the 202C) processed into coincidence by 1 time of the send] can be changed to the one engine cylinder head 200.
[0117] In order to secure the function, especially the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 have many which are inclined and prepared, and since whenever [this tilt-angle] is usually different with the class of engine cylinder head 200, when changing to the engine cylinder head of the class from which the engine cylinder head 200 differs, they need modification of the inclination posture of the engine cylinder head 200 in many cases. And since it can do only in control by the fixture 10, without modification of the inclination posture of the engine cylinder head 200 converting a fixture 10 sharply at this time, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.
[0118] Moreover, whenever [tilt-angle / of the engine cylinder head 200] Like the gestalt of not only between the engine cylinder heads 200 of a different class but this operation for example, since it may be different also within the one engine cylinder head 200 like an "inspired air flow path inclination posture" and a "exhaust side inclination posture" Even if it is the same engine cylinder head 200, when the functional holes 201A, 201B, 201C, 202A, 202B, and 202C for processing differ, modification of the inclination posture of the engine cylinder head 200 is needed in many cases. At this time, and modification of the inclination posture of the engine cylinder head 200 The fixture 10 of dedication is not formed in every exhaust side inclination posture". the conventional technique -- like -- "an inspired air flow path inclination posture" -- "-- Since it can do only in control by the common fixture 10 at each stations A, B, C, D, E, and F, design costs become cheap by communalization of a fixture 10, and it can contribute to reduction of an initial cost.
[0119] Moreover, in each stations A, B, C, D, and E and the jig 10 installed on F, in case it insists upon the engine cylinder head 200, positioning of the engine cylinder head 200 is secured with the locator pin 50 prepared in the ROKETO member 49 (reference, such as drawing 4). And in this ROKETO member 49, arrangement conditions, such as a location of a locator pin 50 and die length, are determined so that it may correspond to the locating hole (not shown) prepared in the engine cylinder head 200. Therefore, the arrangement condition of a locator pin 50 can be changed by exchanging the ROKETO member 49 attached in a fixture 10 to other ROKETO members 49 from which the arrangement condition of a locator pin 50 differs.
[0120] Since the shape especially of surface type of the engine cylinder head 200 is different with the class of engine cylinder head 200 in many cases, in changing to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, the location of a locating hole (not shown) established in the engine cylinder head 200 is obliged to modification in many cases, and needs modification of the arrangement condition of a locator pin 50 in many cases. And without modification of the arrangement condition of a locator pin 50 converting a fixture 10 sharply at this time, since it can do only by exchanging the ROKETO member 49, even if it changes to the engine cylinder head 200 of the class

from which the engine cylinder head 200 differs, an excessive additional investment is not needed.
[0121] Moreover, in each stations A, B, C, D, and E and the jig 10 installed on F, in case it insists upon the engine cylinder head 200, it is insisting upon the engine cylinder head 200 by the clamp pin 21 prepared in the clamper 34 (reference, such as drawing 7). And in this clamper 34, arrangement conditions, such as a location of the clamp pin 21 and die length, are determined in consideration of the part by which a pressure welding is carried out to the engine cylinder head 200. Therefore, the arrangement condition of the clamp pin 50 can be changed by exchanging the clamper 34 attached in a fixture 10 to other clampers 34 from which the arrangement condition of the clamp pin 50 differs.
[0122] Since the shape especially of surface type of the engine cylinder head 200 is different with the class of engine cylinder head 200 in many cases, in changing to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, the part by which a pressure welding is carried out to the engine cylinder head 200 is obliged to modification in many cases, and needs modification of the arrangement condition of the clamp pin 21 in many cases. And without modification of the arrangement condition of the clamp pin 21 converting a fixture 10 sharply at this time, since it can do only by exchanging a clamper 34, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.
[0123] namely, in the transfer machine 1 of the gestalt of this operation Since the change in the spindle head 63 arranged in on XZ shaft delivery unit 61 was enabled, enhancement and reduction of the maximum production capacity are attained after the manufacture and the original maximum production capacity can be suppressed low Since it can contribute to reduction of an initial cost and a spindle head 63, a motor 64, coupling 65, etc. can be diverted, while design costs are cheap and end Since new plant-and-equipment investment does not almost have this thing in the case of enhancement and reduction of the maximum production capacity, and the connection structure of a spindle head 63 or a motor 64 is monotonous, and the manufacture costs are also cheap and can finish it further It can respond by low cost to fluctuation of the volume of the engine cylinder head 200 which is work.
[0124] By moreover, exchange of housing 62, control by the fixture 10, exchange of the ROKETO member 49, and exchange of a clamper 34 The functional holes 201A, 201B, and 201C of the engine cylinder head 200, Modification of pitch spacing of 202A, 202B, and 202C, functional hole 201A of the engine cylinder head 200, Modification of whenever [tilt-angle / of 201B, 201C, 202A 202B, and 202C], Modification of the location of the locating hole (not shown) of the engine cylinder head 200, Since it can respond to modification of the pressure-welding part of the clamp pin 50 to the engine cylinder head 200 and an excessive additional investment is not needed in that case, it can respond by low cost to "a change of the engine cylinder head 200" which is work.
[0125] In addition, although it may be accompanied by program modification to control of XZ shaft delivery unit 61, modification of each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively, etc. in the case of fluctuation of the volume of the engine cylinder head 200 which is work, and "a change of the engine cylinder head 200" which is work, about them, each can respond by low cost.
[0126] Moreover, it sets to each stations A, B, C, D, and E and the jig 10 installed on F. From it being freely controllable, the inclination posture of the engine cylinder head 200 It becomes possible to make a "horizontal standing position" communalize the posture of the engine cylinder head 200 at the time of adherence by the fixture 10 being canceled at all stations. By this Since the posture of the engine cylinder head 200 at the time of conveyance to each stations A, B, C, D, E, and F and taking out can also be made to communalize with a "horizontal standing position" The thing equivalent to the posture inverter 106 stated in the column of the conventional technique can be lost, and an initial cost can be low held down also from this viewpoint.
[0127] moreover, the time amount which the change in a spindle head 63, exchange of housing 62, exchange of the ROKETO member 49, and exchange of a clamper 34 take is markedly boiled compared with the time amount which large reconstruction of the conventional technique takes, since it is short, can prevent the shutdown of production over a long period of time, and can make profitability of plant-and-equipment investment high also from this viewpoint.

[0128] Moreover, by having lost the thing equivalent to the posture inverter 106 stated in the column of the conventional technique, it can become possible to also lose the pars intermedia 103 of drawing 18 , and the occupancy area of a transfer machine 1 can be decreased (refer to drawing 1).
[0129] As shown in drawing 12 , moreover, each of the monopodium (spindle 66) of a spindle head 63 Since it connects with one motor 64 by coupling 65 and has the configuration of the so-called motor direct drive of 1 shaft configuration Compared with the belt coupling explained in the column of the conventional technique (refer to drawing 21), each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively can be rotated at high speed.
[0130] Furthermore, since facility height low ** can be stopped and the prospect nature of the whole facility becomes good compared with the transfer machine 100 which has the belt coupling explained in the column of the conventional technique by having the configuration of the so-called motor direct drive of 1 shaft configuration (R> drawing 21 1 reference), the transfer machine 1 of the gestalt of this operation can contribute to improvement in safety and integrity.
[0131] Moreover, a spindle head 63 can make the appearance configuration of a spindle head 63 a circle configuration for a monopodium. And the chip and coolant liquid at the time of cutting which becomes possible [equipping wrap covering only with a fixture 10], and generates the seal (scraper) of the circle configuration corresponding to the circle configuration in a fixture 10 can prevent dispersing to the exterior efficiently with this covering. That is, in the transfer machine 100 of the conventional technique, since the appearance configuration of a gearbox 141 is carrying out the rectangle and had covered the transfer machine 100 whole with covering triggered by the difficulty of the seal nature of this rectangle, in the transfer machine 1 of the gestalt of this operation, miniaturization of covering is attained and manufacture costs can be reduced.
[0132] Moreover, in conveyance with the transformer bar (not shown) in the transfer machine 100 of the conventional technique, the engine cylinder head 200 is conveyed with the "inspired air flow path inclination posture" or the "exhaust side inclination posture." However, in conveyance with the transformer bar (not shown) in the transfer machine 1 of the gestalt of this operation, the engine cylinder head 200 is conveyed with the "horizontal standing position", and it can be said that the stability at the time of conveyance is more excellent compared with an "inspired air flow path inclination posture" and a "exhaust side inclination posture." Therefore, in case it sends to the attaching part 31 of a fixture 10 or sends out, there is no possibility that the engine cylinder head 200 and a fixture 10 may interfere mutually, and may get damaged.
[0133] In addition, various modification is possible for this invention in the range which is not limited to the gestalt of the above-mentioned implementation and does not deviate from the meaning. For example, it sets to the roller conveyor 108 of the carrying-in section 102, and the roller conveyor 109 of the taking-out section 104. if it does not "erection posture" come out of the engine cylinder head 200 and is made to convey with a "horizontal standing position" Since the posture inverter 15 which changes the engine cylinder head 200 into a "horizontal standing position" from an "erection posture", and the posture inverter 17 which changes the engine cylinder head 200 into an "erection posture" from a "horizontal standing position" can be lost Furthermore, an initial cost can be held down low.
[0134]
[Effect of the Invention] Since the change in the spindle head arranged in on XZ shaft delivery unit was enabled in the transfer machine of this invention, enhancement and reduction of the maximum production capacity are attained after the manufacture and the original maximum production capacity can be suppressed low Since it can contribute to reduction of an initial cost and a spindle head, a motor, coupling, etc. can be diverted, while design costs are cheap and end Since new plant-and-equipment investment does not almost have this thing in the case of enhancement and reduction of the maximum production capacity, and the connection structure of a spindle head or a motor is monotonous, and the manufacture costs are also cheap and can finish it further It can respond by low cost to fluctuation of the volume of the engine cylinder head which is work.
[0135] By moreover, exchange of housing, control by the fixture, exchange of a ROKETO member, and exchange of a clamp member Modification of pitch spacing of the functional hole of the engine cylinder

head, modification of whenever [tilt-angle / of the functional hole of the engine cylinder head], Since it can respond to modification of the location of the locating hole of the engine cylinder head, and modification of the pressure-welding part of the clamp pin to the engine cylinder head and an excessive additional investment is not needed in that case It can respond by low cost to "a change of the engine cylinder head" which is work.

[0136] Moreover, it sets to the jig installed on each station. It becomes possible to make the posture of the engine cylinder head at the time of adherence by the fixture being canceled communalize at all stations, since the inclination posture of the engine cylinder head is freely controllable. By this Since the posture of the engine cylinder head at the time of conveyance to each station and taking out can also be made to communalize It becomes possible to lose a part or all among three posture transfer devices stated in the column of the conventional technique, and an initial cost can be low held down also from this viewpoint.

[0137] moreover, the time amount which the change in a spindle head, exchange of housing, exchange of a ROKETO member, and exchange of a clamp member take is markedly boiled compared with the time amount which large reconstruction of the conventional technique takes, since it is short, can prevent the shutdown of production over a long period of time, and can make profitability of plant-and-equipment investment high also from this viewpoint.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the transfer machine into which the functional hole (here, what forms a bearing surface is included) of the engine cylinder head is processed.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] Before, various functional holes, such as a path of the hole which lets a part of combustion chamber (only henceforth a "combustion chamber"), a water jacket, and an intake valve and an exhaust air bulb pass, the inhalation-of-air hole and exhaust hole which are a gas passageway, the hole in which a plug is inserted, and a lubricating oil, are intricately prepared in the engine cylinder head which is the head of engines, such as an automobile. For example, in the top view of drawing 14 , when the P-P line of drawing 14 cuts the engine cylinder head 200 of 6-cylinder 4 bulb shown from the "combustion chamber side", it turns out that it comes to be shown in drawing 15 and various functional holes are prepared intricately. In addition, in drawing 14 , a total of four holes of the hole which lets two intake valves pass, and the hole which lets two exhaust air bulbs pass can be seen in each of six "combustion chambers."
[0003] And as shown in drawing 15 , about the circumference of the axis 201 (only henceforth "an axis 201") of the intake valve at the time of being installed inside by the engine cylinder head 200, it is dotted with the functional holes 201A, 201B, and 201C with which paths differed focusing on the starting "axis 201" in serial. It is dotted with the functional holes 202A, 202B, and 202C with which paths differed focusing on the "axis 202" which similarly starts also about the circumference of the axis 202 (only henceforth "an axis 202") of the exhaust air bulb at the time of being installed inside by the engine cylinder head 200 in serial. Then, paying attention to the property of being dotted in serial focusing on such "an axis 201" and "an axis 202", the production system of a transfer system is performing further processing of these functional holes 201A, 201B, 201C, 202A, 202B, and 202C in consideration of productivity etc.
[0004] And in processing by the production system of this transfer system, it is performing sending out two or more rotating tools to coincidence by controlling with XZ shaft in the both sides of each station. On the other hand, in the engine cylinder head 200, as shown in drawing 15 , "the axis 201" and the "axis 202" incline and it is dotted with the functional holes 201A, 201B, and 201C for processing, and the functional holes 202A, 202B, and 202C for processing in serial in the condition of having inclined. Then, at each station, the engine cylinder head 200 is fixed to an inclination posture, and either the "axis 201" of the engine cylinder head 200 or the "axis 202" is united in the direction of a coincidence send of two or more rotating tools (Z shaft orientations) by this.
[0005] When the direction of a coincidence send of two or more rotating tools (Z shaft orientations) is specifically level and the functional holes 201A, 201B, and 201C of the circumference of "an axis 201" are processed, as shown in drawing 16 , "an axis 201" is the inclination posture which becomes level, and fixes the engine cylinder head 200. And "an axis 201" is in a condition parallel to the Z-axis on the flat surface formed with XZ shaft at this time. On the other hand, when processing the functional holes 202A, 202B, and 202C of the circumference of "an axis 202", as shown in drawing 17 , it is the inclination posture in which "an axis 202" becomes level, and the engine cylinder head 200 is fixed. And "an axis 202" is in a condition parallel to the Z-axis on the flat surface formed with XZ shaft at this time.

[0006] In addition, the inclination posture of the engine cylinder head 200 of drawing 16 after

[expedient] that the following explains is called an "inspired air flow path inclination posture." Moreover, the inclination posture of the engine cylinder head 200 of drawing 17 is called a "exhaust side inclination posture." Furthermore, the posture of the engine cylinder head 200 of drawing 15 is called an "erection posture."

[0007] Next, the outline is explained for a drawing about the transfer machine of the conventional technique of processing the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 with the production system of a transfer system, making it reference. A top view shows the outline of the transfer machine 100 of the conventional technique to drawing 18 . In this transfer machine 100, the carrying-in section 102, pars intermedia 103, and the taking-out section 104 are formed on Rhine 101 where the engine cylinder head 200 is conveyed. And are prepared by a roller conveyor 108, the posture inverter 105, etc. for carrying in, and it is in the carrying-in section 102. Moreover, are prepared by the posture inverter 106 etc. and it is in pars intermedia 103. Moreover, the posture inverter 107, the roller conveyor 109 for taking out, etc. are formed in the taking-out section 104.

[0008] Furthermore, while three stations A, B, and C are formed between the carrying-in section 102 and pars intermedia 103, the fixture 110 is installed on each stations A and B and C. Similarly, while three stations E, F, and G are formed also between pars intermedia 103 and the taking-out section 104, the fixture 111 is installed on each stations E and F and G. And are prepared by the processing machine 112 and it is in the both sides of each stations A, B, C, D, E, and F.

[0009] Here, the outline of the posture inverters 105, 106, and 107 mentioned above, fixtures 110 and 111, and the processing machine 112 is explained.

[0010] First, the outline of the posture inverters 105, 106, and 107 is explained, referring to drawing 19 . Drawing 1919 is a front view having shown the outline of the posture inverter 105 prepared in the carrying-in section 102. The posture inverter 105 consists of an attaching part 121, a seating rim 122, a cylinder 123, an outer frame 124, etc. An attaching part 121 holds the engine cylinder head 200 by the rail 125 of L typeface, and the rail 126 of a rod form, and is prepared inside the seating rim 122. Moreover, the periphery carries out a radii configuration and the seating rim 122 is connected with the cylinder 123 rotatable. On the other hand, the cylinder 123 is supported by the outer frame 124 rotatable. Moreover, six guide idlers 127 to which it shows the periphery of the radii configuration of a seating rim 122 are formed in the outer frame 124.

[0011] Therefore, when the rod of a cylinder 123 is extruded or it is drawn, the periphery of a seating rim 122 will be guided at the guide idler 127 of an outer frame 124, and a seating rim 122 will rotate to the forward direction or hard flow. Consequently, the attaching part 121 prepared inside the seating rim 122 will rotate to the forward direction or hard flow similarly. It enables this to change into an "inspired air flow path inclination posture" the engine cylinder head 200 held with the "erection posture" at the attaching part 121, while it had been held at the attaching part 121. At this time, the "erection posture" and an "inspired air flow path inclination posture" of the engine cylinder head 200 held at the attaching part 121 are the limit switch (not shown) formed in the outer frame 124, and are secured by making the forward direction or hard flow of a seating rim 122 suspend rotation.

[0012] In addition, the same is said of the outline of the posture inverter 106 prepared in pars intermedia 103, and, thereby, it becomes possible [changing the engine cylinder head 200 into a "exhaust side inclination posture" from an "inspired air flow path inclination posture"]. Moreover, the same is said of the outline of the posture inverter 107 prepared in the taking-out section 104, and, thereby, it becomes possible [changing the engine cylinder head 200 into an "erection posture" from a "exhaust side inclination posture"].

[0013] Next, the outline of fixtures 110 and 111 is explained, referring to drawing 20 . Drawing 20 is the front view having shown the outline of the fixture 110 installed in each stations A, B, and C. The fixture 110 has the adherence section 131 which insists upon the engine cylinder head 200 with an "inspired air flow path inclination posture." This adherence section 131 consists of cylinders 135 which are the rail 133 which supports and maintains the engine cylinder head 200 which carries out the plane of composition of becoming an "inspired air flow path inclination posture" to the datum plane 132 to

secure and a datum plane 132 from a part of engine cylinder head 200 carrying out a plane of composition, the clamper 134 for making a datum plane 132 carry out the plane of composition of the engine cylinder head 200 by the position, and the driving source of a clamper 134. As mentioned above, since the engine cylinder head 200 upon which it insisted in the fixture 110 is in an "inspired air flow path inclination posture", the stations A, B, and C in which this fixture 110 was installed are the locations for processing the functional holes 201A, 201B, and 201C (referring to drawing 16) of the circumference of "an axis 201."

[0014] In addition, in order to make it each tool (not shown) of a machine tool 112 arrive to the engine cylinder head 200 upon which it insisted in the fixture 110, opening 136 is formed in datum level 132. moreover, the clamper 134 side with opposite datum level 132 -- clear -- illustration -- now, although it is absent, opening for making it each tool (not shown) of a machine tool 112 arrive is prepared.

[0015] On the other hand, compared with the fixture 110 (what was installed in each stations A, B, and C) of drawing 20 , since the fixture 111 (refer to drawing 18) installed in each stations E, F, and G insists upon the engine cylinder head 200 with a "exhaust side inclination posture", although it is equivalent to the datum level 132 and clamper 134, whenever [tilt-angle] etc. differ. However, about other outlines, it is the same as that of the fixture 110 (what was installed in each stations A, B, and C) of drawing 20 . As mentioned above, since the engine cylinder head 200 upon which it insisted in the fixture 111 is in a "exhaust side inclination posture", the stations E, F, and G in which this fixture 111 was installed are the locations for processing the functional holes 202A, 202B, and 202C (referring to drawing 17) of the circumference of "an axis 202."

[0016] Next, the outline of the processing machine 112 is explained, referring to drawing 2121 and drawing 22 . Drawing 21 is the front view having shown the outline of the processing machine 112 prepared in the both sides of each stations A, B, C, E, F, and G. Moreover, drawing 2222 is a sectional view cut by the Q-Q line of drawing 21 . The processing machine 112 processes the functional holes 201A, 201B, and 201C (refer to drawing 16) of the engine cylinder head 200 upon which the fixture 110 insisted with the "inspired air flow path inclination posture", or the functional holes 202A, 202B, and 202C (refer to drawing 17) of the engine cylinder head 200 upon which the fixture 111 insisted with the "exhaust side inclination posture."

[0017] Moreover, as the processing machine 112 is shown in drawing 21 , a gearbox 141, a motor 142, etc. are laid on the table 144 of XZ shaft delivery unit. And the spindle 145, the change gear style, etc. are built in the gearbox 141. Here, it has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 (refer to drawing 14), and six spindles 145 are dedicated together with the inside of a gearbox 141. And it can be made to rotate by two motors 142 through a change gear style or a driving belt 143 about six spindles 145 dedicated in the gearbox 141. Therefore, it becomes possible to rotate each tool (not shown) attached in the axis end of this spindle 145. Furthermore, each rotating tool (not shown) can be sent out to coincidence through XZ shaft delivery unit of a table 144, being controlled with XZ shaft. By these, it becomes processible by each tool (not shown) attached in the axis end of six spindles 145.

[0018] In addition, about each tool (not shown), the thing according to the magnitude of the path of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C used as the candidate for processing, the process of processing, etc. is attached to the axis end of each spindle. Moreover, XZ shaft used in case it controls with XZ shaft delivery unit of a table 144 consists of a shaft (X-axis) parallel to Rhine 101 where the engine cylinder head 200 is conveyed, and a shaft (Z-axis) parallel to the medial axis of the spindle 145 which exists in the vertical and horizontal direction to it, and was dedicated in the gearbox 141 (refer to the drawing 1818).

[0019] Next, the transfer machine 100 with such an outline explains how to process the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200. First, in the roller conveyor 108 of the carrying-in section 102, the engine cylinder head 200 of an "erection posture" is carried in. And the engine cylinder head 200 on a roller conveyor 108 is horizontally extruded by the cylinder which is not illustrated with an "erection posture", and is pushed on the attaching part 121 of the posture inverter 105 in it.

[0020] In the posture inverter 105, if the engine cylinder head 200 is pushed on an attaching part 121, the rod of a cylinder 123 will be made to draw and the engine cylinder head 200 held at the attaching part 121 will be changed into an "inspired air flow path inclination posture" from an "erection posture." Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 121 is caught from the bottom, is horizontally conveyed with an "inspired air flow path inclination posture", and is sent to the adherence section 131 of the fixture 110 of Station A.
[0021] When the engine cylinder head 200 of an "inspired air flow path inclination posture" is sent to the adherence section 131, extrude the rod of a cylinder 135, the engine cylinder head 200 is made to press a clamper 134, and datum level 132 is made to carry out the plane of composition of the engine cylinder head 200 by the position in the fixture 110 of Station A. And the transformer bar which is not illustrated is retreated to the bottom. Thereby, the engine cylinder head 200 is correctly fixed with an "inspired air flow path inclination posture", and the "axis 201" of the engine cylinder head 200 will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, by controlling by XZ shaft delivery unit of the table 144 of the machine tool 112 in the both sides of Station A, it sends out so that the "axis 201" top may be met. [of the engine cylinder head 200 upon which it insisted the tool (not shown) attached in the axis end of each spindle 145 dedicated in the gearbox 141, respectively in the fixture 110]
[0022] This becomes processible [the functional holes 201A, 201B, and 201C of the engine cylinder head 200 upon which it insisted in the fixture 110]. However, at Station A, functional hole 201A is roughed by one side of the machine tool 112 in the both sides, and functional hole 201C is roughed on the other hand. And since six spindles 145 dedicated in the gearbox 141 of a machine tool 112 are located in a line with pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, each tool (not shown) attached in the axis end of six spindles 145, respectively has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, and it is sent out to coincidence. Therefore, in each of six the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201A is performed to coincidence by 1 time of the send in one machine tool 112 at this time. Moreover, in each of six the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201C is similarly performed to coincidence by 1 time of the send by the machine tool 112 of another side.
[0023] However, the engine cylinder head 200 is the thing of 6-cylinder 4 bulb, and since two intake valves are installed inside to one a "combustion chamber", the two "axes 201" exists in one a "combustion chamber" (refer to drawing 14). that is, in processing mentioned above, six the "combustion chambers" established in the engine cylinder head 200 is alike, respectively, and it sets, and it is carried out about the functional holes 201A and 201C with which it is dotted in serial focusing on one the "axis 201" between the two "axes 201", and asks and comes out.
[0024] Then, processing of the functional holes 201A and 201C with which it is dotted in serial focusing on the "axis 201" of another side is performed by setting after that and controlling the tool (not shown) further attached in the axis end of the spindle 145 dedicated in the gearbox 141 by XZ shaft delivery unit of the table 144 of a machine tool 112. Therefore, at Station A, roughing of send out, namely, according to one machine tool 112 functional hole 201in one machine tool 112 A is performed twice. Similarly, roughing of send out, namely, according to machine tool 112 of another side functional hole 201C in the machine tool 112 of another side is performed twice. Thereby, at Station A, roughing is performed about all the functional hole 201A of the engine cylinder head 200, and functional hole 201C.
[0025] Thus, after processing in Station A is completed, the rod of a cylinder 135 is drawn, a clamper 134 is pulled apart from the engine cylinder head 200, and the plane of composition over the datum level 132 of the engine cylinder head 200 is made to cancel in the fixture 110 of Station A. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 131 is caught from the bottom, is horizontally conveyed with an "inspired air flow path inclination posture", and is sent to the adherence section 131 of the fixture 110 of Station B.
[0026] Also at Station B, it is performed that it is the same as that of the station A mentioned above. However, the point of roughing functional hole 201B by one side of the machine tool 112 in the both

sides, and roughing finish of functional hole 201B on the other hand after **** differs from the point that the engine cylinder head 200 is sent to the adherence section 131 of the fixture 110 of Station C after this processing termination. Moreover, also at Station C, it is performed that it is the same as that of the station A mentioned above. However, the point of performing finish of functional hole 201C on the other hand while finish-machining functional hole 201A by one side of the machine tool 112 in the both sides differs from the point that the engine cylinder head 200 is sent to pars intermedia 103 after this processing termination. As mentioned above, it means that processing of all the functional holes 201A, 201B, and 201C was performed in the engine cylinder head 200 sent to pars intermedia 103.

[0027] In addition, conveyance horizontally performed in the engine cylinder head 200 with the transformer bar which is not illustrated with an "inspired air flow path inclination posture" Conveyance to the fixture 110 of Station A from the posture inverter 105, conveyance to the fixture 110 of Station B of Station A from a fixture 110, Both conveyance to the fixture 110 of Station C of Station B from a fixture 110 and conveyance to pars intermedia 103 from the fixture 110 of Station C are performed by one transformer bar in synchronization.

[0028] Next, the engine cylinder head 200 sent to pars intermedia 103 is horizontally extruded even to the posture inverter 106 by the cylinder which is not illustrated with an "inspired air flow path posture." In the posture inverter 106, the engine cylinder head 200 is changed into a "exhaust side posture" from an "inspired air flow path posture." It sets after that and it is performed that it is the same as that of the case where it mentions above from the posture inverter 105 of the carrying-in section 102 to pars intermedia 103.

[0029] That is, in pars intermedia 103, the engine cylinder head 200 held at the attaching part of the posture inverter 106 is horizontally sent to the adherence section of the fixture 111 of Station D with a "exhaust side posture." Moreover, at Station D, while roughing functional hole 202A by one side of the machine tool 112 in the both sides, functional hole 202C is roughed on the other hand, and the engine cylinder head 200 is horizontally sent to the adherence section of the fixture 111 of Station E for after this processing termination with a "exhaust side posture." Moreover, at Station E, functional hole 202B is roughed by one side of the machine tool 112 in the both sides, finish of functional hole 202B is roughed on the other hand after ****, and the engine cylinder head 200 is horizontally sent to the adherence section of the fixture 111 of Station F for after this processing termination with a "exhaust side posture." Moreover, at Station F, while performing finish of functional hole 202A by one side of the machine tool 112 in the both sides, finish of functional hole 202C is performed on the other hand, and the engine cylinder head 200 is horizontally sent to the attaching part of the posture inverter 107 of the taking-out section 104 for after this processing termination with a "exhaust side posture."

[0030] As mentioned above, it means that it means that processing of all the functional holes 202A, 202B, and 202C was performed, it has, and all processings of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 were completed in the engine cylinder head 200 sent to the taking-out section 104. After that, the engine cylinder head 200 held at the attaching part of the posture inverter 107 of the taking-out section 104 is changed into an "erection posture" from a "exhaust side posture", and is horizontally extruded on a roller conveyor 109 by the cylinder which is not illustrated with an "erection posture." And it is taken out to the exterior of a transfer machine 100 by the roller conveyor 109.

[0031] In addition, since the two "axes 201" exists in each of six "combustion chambers" in the engine cylinder head 200 of 6-cylinder 4 bulb shown in drawing 14 as mentioned above, the a total of 12 "axes 201" will exist in the one engine cylinder head 200. Therefore, when the engine cylinder head 200 is in an "inspired air flow path posture", all the 12 "axes 201" will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, if it has 12 spindles 145 in the gearbox 141 of each machine tool 112, it will set to Station A, for example. It becomes possible to make roughing of functional hole 201A by one machine tool 112 and roughing of functional hole 201C by the machine tool 112 of another side finish it as 1 time of a send, respectively. Compared with the thing of the conventional technique mentioned above which performs those processings by 2 times each of sends, it is thought that high-volume production capability increases further. However, each spacing of the 12 "axes 201" in the one

engine cylinder head 200 is narrow, and it is difficult in tooth space to arrange 12 spindles 145 in all in a gearbox 141 to the 12 "axes 201." This can be said also about "an axis 202."
[0032] Namely, six spindles 145 in the gearbox 141 of each machine tool 112 Arrange with pitch spacing of six the "combustion chambers" established in the one engine cylinder head 200, and it sets to each stations A, B, C, D, E, and F. The transfer machine 100 which performs processing by the machine tool 112 of both sides by 2 times of sends, respectively and which was mentioned above It can be said that it is the production system of the transfer system which pursued high-volume production capability to the maximum extent for processing of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 of 6-cylinder 4 bulb.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since the change in the spindle head arranged in on XZ shaft delivery unit was enabled in the transfer machine of this invention, enhancement and reduction of the maximum production capacity are attained after the manufacture and the original maximum production capacity can be suppressed low Since it can contribute to reduction of an initial cost and a spindle head, a motor, coupling, etc. can be diverted, while design costs are cheap and end Since new plant-and-equipment investment does not almost have this thing in the case of enhancement and reduction of the maximum production capacity, and the connection structure of a spindle head or a motor is monotonous, and the manufacture costs are also cheap and can finish it further It can respond by low cost to fluctuation of the volume of the engine cylinder head which is work.

[0135] By moreover, exchange of housing, control by the fixture, exchange of a ROKETO member, and exchange of a clamp member Modification of pitch spacing of the functional hole of the engine cylinder head, modification of whenever [tilt-angle / of the functional hole of the engine cylinder head], Since it can respond to modification of the location of the locating hole of the engine cylinder head, and modification of the pressure-welding part of the clamp pin to the engine cylinder head and an excessive additional investment is not needed in that case It can respond by low cost to "a change of the engine cylinder head" which is work.

[0136] Moreover, it sets to the jig installed on each station. It becomes possible to make the posture of the engine cylinder head at the time of adherence by the fixture being canceled communalize at all stations, since the inclination posture of the engine cylinder head is freely controllable. By this Since the posture of the engine cylinder head at the time of conveyance to each station and taking out can also be made to communalize It becomes possible to lose a part or all among three posture transfer devices stated in the column of the conventional technique, and an initial cost can be low held down also from this viewpoint.

[0137] moreover, the time amount which the change in a spindle head, exchange of housing, exchange of a ROKETO member, and exchange of a clamp member take is markedly boiled compared with the time amount which large reconstruction of the conventional technique takes, since it is short, can prevent the shutdown of production over a long period of time, and can make profitability of plant-and-equipment investment high also from this viewpoint.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the transfer machine 100 mentioned above was difficult for the maximum production capacity to reinforce or reduce after the manufacture. Therefore, in order for this maximum production capacity to demonstrate the high-volume production capability which is the advantage of the production system of a transfer system, usually it was designed so that it could fully respond to the maximum production size expected. And to the change in a volume it is supposed that will be happened in the future, it corresponded by adjustment of the cycle time of the engine cylinder head 200 conveyed at each stations A, B, C, D, E, and F, and was carried out within the limits of the maximum production capacity set as the beginning.

[0034] Therefore, it was not extended, so that the volume expected, but when the high-volume production capability whose period which adjusted the cycle time of the engine cylinder head 200 is the advantage of the production system of a transfer system became long to extent which cannot be demonstrated effectively, conversely, the advantage of this high-volume production capability converted to the fault of superfluous capacity, and there was a possibility that the profitability of plant-and-equipment investment might get very bad. Especially Functional hole 201A of the engine cylinder heads 200, such as an automobile, In the transfer machine 100 which makes 201B, 201C, 202A, 202B, and 202C applicable to processing In the case which is as inelastic as the amount of orders received, such as an automobile, was expected, the case changed to the engine cylinder head 200 of a different class in the case of model changes, such as an automobile Since it is a certain thing plentifully that the volume of the engine cylinder head 200 falls short of anticipation, it can be said that the danger is large.

[0035] Moreover, to the change to the engine cylinder head 200 of a class which is different from the engine cylinder head 200, whenever [pitch spacing / of the "combustion chamber" of the engine cylinder head 200 / and tilt-angle / of "an axis 201" and "an axis 202"], when an appearance etc. is different, whenever [pitch spacing / of the spindle 145 of each machine tool 112 / and tilt-angle / of the datum level 132 of each fixtures 110 and 111], the location of a clamper 134, etc. must be changed in principle. however, about the location of whenever [pitch spacing / of the spindle 145 of each machine tool 112 / and tilt-angle / of the datum level 132 of each fixtures 110 and 111], or a clamper 134 Since it cannot do structurally, in order to correspond to the change to the engine cylinder head 200 of a class which is different from the engine cylinder head 200, adjusting them There was a possibility that all the machine tool 112 and all fixtures 110 and 111 might be converted sharply, an additional investment might become excessive, and the profitability of plant-and-equipment investment might get very bad. Especially Functional hole 201A of the engine cylinder heads 200, such as an automobile, In the transfer machine 100 which makes 201B, 201C, 202A, 202B, and 202C applicable to processing In the case changed to the engine cylinder head 200 of a different class in the case of model changes, such as an automobile Since it is a certain thing plentifully to change to the engine cylinder head 200 of a class which is different from the engine cylinder head 200 (only henceforth "a change of the engine cylinder head 200"), it can be said that the danger is large.

[0036] Then, this invention is made in order to solve the trouble mentioned above, and it aims at offering the transfer machine which can respond by low cost to "a change of the engine cylinder head"

which is work as opposed to fluctuation of the volume of the engine cylinder head which is work.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] The transfer machine concerning claim 1 accomplished in order to attain this purpose By sending out to coincidence in XZ shaft delivery unit, rotating each tool attached in the axis end of two or more spindles arranged beside [each] the station, respectively, when the engine cylinder head is fixed on each station While processing many functional holes into coincidence by 1 time of the send to the one engine cylinder head at each station By conveying the one engine cylinder head one by one to each station While being the transfer machine which performs processing to the functional hole of the one engine cylinder head in order of each process, arranging in on said XZ shaft delivery unit the spindle head of the monopodium which dedicated only one spindle and sending out each tool to coincidence By making one spindle in each spindle head connect with one motor by coupling, and rotating each tool The change in the spindle head arranged in on said XZ shaft delivery unit is enabled, and it is characterized by the ability to change the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station.
[0038] Moreover, the transfer machine concerning claim 2 be a transfer machine indicate to claim 1, by attach housing with which said spindle head be fix in juxtaposition on said XZ shaft delivery unit, secure pitch spacing of the spindle head arrange in on said XZ shaft delivery unit, and be characterize by to secure pitch spacing of the functional hole process into coincidence by 1 time of the send to the one engine cylinder head at each station.
[0039] moreover , the transfer machine concerning claim 3 be a transfer machine indicate to claim 2 , by exchange said housing in said housing and other compatible housing , enable a setup of pitch spacing of the spindle head arrange in on said XZ shaft delivery unit , and be characterize by the ability to be able to change pitch spacing of the functional hole process into coincidence by 1 time of the send to the one engine cylinder head at each station .
[0040] Moreover, the transfer machine concerning claim 4 When the engine cylinder head is fixed with an inclination posture on each station By sending out to coincidence in XZ shaft delivery unit, rotating each tool attached in the axis end of two or more spindles arranged beside [each] the station, respectively While processing many functional holes into coincidence by 1 time of the send to the one engine cylinder head at each station By conveying the one engine cylinder head one by one to each station It is the transfer machine which performs processing to the functional hole of the one engine cylinder head in order of each process. By controlling the inclination posture of said engine cylinder head, insisting upon said engine cylinder head with the jig installed on each station It is characterized by the ability to change whenever [tilt-angle / of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station].
[0041] Moreover, the transfer machine concerning claim 5 is a transfer machine indicated to claim 4, and is characterized by the ability to change the arrangement condition of said locator pin by attaching in said jig the ROKETO member in which the locator pin for securing positioning of said engine cylinder head was prepared, and exchanging said ROKETO member to said ROKETO member and other compatible ROKETO members.
[0042] Moreover, the transfer machine concerning claim 6 is a transfer machine indicated to ******** 4

or claim 5, and is characterized by the ability to change the arrangement condition of said clamp pin by attaching in said jig the clamp member in which the clamp pin for insisting upon said engine cylinder head was prepared, and exchanging said clamp member to said clamp member and other compatible clamp members.
[0043] the monopodium (spindle) of each spindle head arranged in on XZ shaft delivery unit beside [each] a station in the transfer machine of this invention which has such a configuration -- it connects with one motor by coupling, respectively. And when the engine cylinder head which is work is fixed on each station, each tool attached in the axis end of the monopodium (spindle) of each spindle head, respectively can be rotated by rotating the monopodium (spindle) of each spindle head by each motor. Furthermore, each tool attached in the axis end of the monopodium (spindle) of each spindle head, respectively can be sent out to coincidence by XZ shaft delivery unit. Thereby, at each station, many functional holes are processible into coincidence to the one engine cylinder head by 1 time of the send.
[0044] With the belt coupling explained in the column of the conventional technique, since connection according to the monopodium (spindle) of a spindle head and coupling of one motor at this time can be performed independently of other spindle head and other motors with that monotonous structure, it can perform easily increasing or reducing the number of each spindle heads arranged in on XZ shaft delivery unit, without large-converting. And a spindle head, a motor, coupling, etc. which were set as the object of increase and decrease can be supplied and diverted among other transfer machines. The change in the spindle head arranged in on XZ shaft delivery unit after manufacture of a transfer machine is attained by this, and the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station can be changed.
[0045] That is, if the number of the spindle heads arranged in on XZ shaft delivery unit is made to increase, since the number of the tools sent out to coincidence in XZ shaft delivery unit can be made to increase, the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station also increases.
[0046] Therefore, at a certain station, when 12 functional holes must be processed to the one engine cylinder head, [for example,] When the number of the spindle heads arranged in on XZ shaft delivery unit beside [concerned] a station is two Since the number of the tools sent out to coincidence in the XZ shaft delivery unit concerned is also two, in order to process 12 functional holes to the one engine cylinder head, it is necessary to perform the coincidence send of each tool by the XZ shaft delivery unit concerned 6 times. However, what is necessary is just to perform the coincidence send of each tool by the XZ shaft delivery unit concerned 4 times at the time of three pieces which increased the one number of the spindle heads arranged in on XZ shaft delivery unit beside [concerned] a station, in order to process 12 functional holes to the one engine cylinder head, since the number of the tools sent out to coincidence in the XZ shaft delivery unit concerned also increases to three pieces. Furthermore, what is necessary is just to perform the coincidence send of each tool by the XZ shaft delivery unit concerned twice at the time of six pieces which increased the three number of the spindle heads arranged in on XZ shaft delivery unit beside [concerned] a station, in order to process 12 functional holes to the one engine cylinder head, since the number of the tools sent out to coincidence in the XZ shaft delivery unit concerned also increases to six pieces.
[0047] Thus, if the number of the spindle heads arranged in on XZ shaft delivery unit is made to increase, since it can decrease the count of a coincidence send of each tool by XZ shaft delivery unit and time amount required for processing in each station will be shortened, the maximum production capacity of a transfer machine can be raised. Therefore, also after a transfer machine is manufactured, the maximum production capacity of a transfer machine can be reinforced by making the number of the spindle heads arranged in on XZ shaft delivery unit increase. When the maximum production size which shall be equivalent to the usual volume which it becomes impossible that it is not necessary to make the maximum production capacity of a transfer machine fully correspond [volume] to the maximum production size expected by this, and has the original maximum production capacity expected, and is expected becomes actual, it becomes possible to reinforce the original maximum production capacity.
[0048] On the contrary, if the number of the spindle heads arranged in on XZ shaft delivery unit is

decreased, since the number of the tools sent out to coincidence in XZ shaft delivery unit can be decreased, the number of the functional holes processed into coincidence by 1 time of the send to the one engine cylinder head at each station also decreases. Therefore, also after a transfer machine is manufactured, the maximum production capacity of a transfer machine can be made to reduce by decreasing the number of the spindle heads arranged in on XZ shaft delivery unit. In addition, it also contains that the number of the spindle heads arranged in on XZ shaft delivery unit becomes one piece here.

[0049] As mentioned above, since the original maximum production capacity can be suppressed low, it can contribute to reduction of an initial cost. Moreover, when reinforcing the maximum production capacity after that, while a spindle head, a motor, coupling, etc. which became unnecessary with other transfer machines can be diverted, when decreasing a volume, it not only corresponds by enlarging the pitch time of the engine cylinder head conveyed at each station, but it can respond by making the maximum production capacity reduce. And when making the maximum production capacity reduce, a spindle head, a motor, coupling, etc. which became unnecessary can be made to divert to other transfer machines. Therefore, new plant-and-equipment investment hardly starts in the case of enhancement and reduction of the maximum production capacity.

[0050] Furthermore, since that to which supply, the spindle head diverted, a motor, coupling, etc. were common among other transfer machines is used in the transfer machine concerned, design costs become cheap. Moreover, since the connection structure by coupling is monotonous and there are also few component part mark, manufacture costs become cheap. Also from these viewpoints, it can contribute to reduction of an initial cost.

[0051] Moreover, in case the monopodium (spindle) of a spindle head is arranged in on XZ shaft delivery unit, it is carried out through housing attached on XZ shaft delivery unit. The location where each spindle head is fixed in juxtaposition is beforehand established in this housing at intervals of the predetermined pitch, and it makes it still easier to fluctuate the spindle head arranged in on XZ shaft delivery unit free. Thereby, pitch spacing of the spindle head arranged in on XZ shaft delivery unit is secured, and security of pitch spacing of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station is made.

[0052] Therefore, by exchanging housing attached on XZ shaft delivery unit in other housing with which the values of pitch spacing differ, a setup of pitch spacing of the spindle head arranged in on XZ shaft delivery unit can be enabled, it has, and it becomes possible to change pitch spacing of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station.

[0053] When two or more especially functional holes of the engine cylinder head are usually prepared at equal intervals by the engine Taki cylinder-ization and it changes to the engine cylinder head of the class from which, as for this pitch spacing, the engine cylinder head differs since it is different with the class of engine cylinder head in many cases, modification of pitch spacing of the monopodium (spindle) of a spindle head is needed in many cases. And without converting sharply modification of pitch spacing of the monopodium (spindle) of a spindle head at this time, since it can do only by exchanging housing, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.

[0054] Moreover, the jig installed on each station can control the inclination posture freely, insisting upon the engine cylinder head. Therefore, whenever [tilt-angle / of the functional hole processed into coincidence by 1 time of the send to the one engine cylinder head at each station] can be changed.

[0055] Especially the functional hole of the engine cylinder head has many which are inclined and prepared in order to secure the function, and whenever [this tilt-angle] needs modification of the inclination posture of the engine cylinder head in many cases, when changing to the engine cylinder head of the class from which the engine cylinder head differs, since it is usually different with the class of engine cylinder head. And since it can do only in control by the fixture, without modification of the inclination posture of the engine cylinder head converting a fixture sharply at this time, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an

excessive additional investment is not needed.
[0056] Moreover, when the functional holes for processing differ even if it is the same engine cylinder head since whenever [tilt-angle / of the engine cylinder head] is different in many cases not only between the engine cylinder heads of a different class but within the one engine cylinder head, modification of the inclination posture of the engine cylinder head is needed in many cases. And since modification of the inclination posture of the engine cylinder head does not prepare the fixture of dedication for every different inclination posture but is possible only in control by the common fixture at each station at this time, design costs become cheap by communalization of a fixture, and it can contribute to reduction of an initial cost.
[0057] Moreover, in the jig installed on each station, in case it insists upon the engine cylinder head, positioning of the engine cylinder head is secured with the locator pin prepared in the ROKETO member. And in this ROKETO member, arrangement conditions, such as a location of a locator pin and die length, are determined so that it may correspond to the locating hole prepared in the engine cylinder head. Therefore, the arrangement condition of a locator pin can be changed by exchanging the ROKETO member attached in a fixture to other ROKETO members from which the arrangement condition of a locator pin differs.
[0058] Since the shape especially of surface type of the engine cylinder head is different with the class of engine cylinder head in many cases, in changing to the engine cylinder head of the class from which the engine cylinder head differs, the location of a locating hole established in the engine cylinder head is obliged to modification in many cases, and needs modification of the arrangement condition of a locator pin in many cases. And without modification of the arrangement condition of a locator pin converting a fixture sharply at this time, since it can do only by exchanging a ROKETO member, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.
[0059] Moreover, in the jig installed on each station, in case it insists upon the engine cylinder head, it is insisting upon the engine cylinder head by the clamp pin prepared in clamp material. And in this clamp member, arrangement conditions, such as a location of a clamp pin and die length, are determined in consideration of the part by which a pressure welding is carried out to the engine cylinder head. Therefore, the arrangement condition of a clamp pin can be changed by exchanging the clamp member attached in a fixture to other clamp members from which the arrangement condition of a clamp pin differs.
[0060] Since the shape especially of surface type of the engine cylinder head is different with the class of engine cylinder head in many cases, in changing to the engine cylinder head of the class from which the engine cylinder head differs, the part by which a pressure welding is carried out to the engine cylinder head is obliged to modification in many cases, and needs modification of the arrangement condition of a clamp pin in many cases. And without modification of the arrangement condition of a clamp pin converting a fixture sharply at this time, since it can do only by exchanging a clamp member, even if it changes to the engine cylinder head of the class from which the engine cylinder head differs, an excessive additional investment is not needed.
[0061] namely, in the transfer machine of this invention Since the change in the spindle head arranged in on XZ shaft delivery unit was enabled, enhancement and reduction of the maximum production capacity are attained after the manufacture and the original maximum production capacity can be suppressed low Since it can contribute to reduction of an initial cost and a spindle head, a motor, coupling, etc. can be diverted, while design costs are cheap and end Since new plant-and-equipment investment does not almost have this thing in the case of enhancement and reduction of the maximum production capacity, and the connection structure of a spindle head or a motor is monotonous, and the manufacture costs are also cheap and can finish it further It can respond by low cost to fluctuation of the volume of the engine cylinder head which is work.
[0062] By moreover, exchange of housing, control by the fixture, exchange of a ROKETO member, and exchange of a clamp member Modification of pitch spacing of the functional hole of the engine cylinder head, modification of whenever [tilt-angle / of the functional hole of the engine cylinder head], Since it

can respond to modification of the location of the locating hole of the engine cylinder head, and modification of the pressure-welding part of the clamp pin to the engine cylinder head and an excessive additional investment is not needed in that case It can respond by low cost to "a change of the engine cylinder head" which is work.
[0063] Moreover, it sets to the jig installed on each station. It becomes possible to make the posture of the engine cylinder head at the time of adherence by the fixture being canceled communalize at all stations, since the inclination posture of the engine cylinder head is freely controllable. By this Since the posture of the engine cylinder head at the time of conveyance to each station and taking out can also be made to communalize It becomes possible to lose a part or all among three posture transfer devices stated in the column of the conventional technique, and an initial cost can be low held down also from this viewpoint.
[0064] moreover, the time amount which the change in a spindle head, exchange of housing, exchange of a ROKETO member, and exchange of a clamp member take is markedly boiled compared with the time amount which large reconstruction of the conventional technique takes, since it is short, can prevent the shutdown of production over a long period of time, and can make profitability of plant-and-equipment investment high also from this viewpoint.
[0065]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is made reference and a drawing is explained. The transfer machine of the gestalt of this operation processes the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 of drawing 14 with the production system of a transfer system as well as the transfer machine 100 explained in the column of the conventional technique.
[0066] A top view shows the transfer machine 1 of the gestalt of this operation to drawing 1 . In order that the transfer machine 1 of the gestalt of this operation may clarify a difference with the transfer machine 100 explained in the column of the conventional technique, it is based on the layout of the transfer machine 100 of the conventional technique shown in drawing 18 , and the same sign used in the column of the conventional technique is used for it about what [common].
[0067] That is, in the transfer machine 1 of the gestalt of this operation, the carrying-in section 102 and the taking-out section 104 are formed on Rhine 101 where the engine cylinder head 200 is conveyed. And are prepared by a roller conveyor 108, the posture inverter 15, etc. for carrying in, and it is in the carrying-in section 102. Moreover, the posture inverter 17, the roller conveyor 109 for taking out, etc. are formed in the taking-out section 104.
[0068] Furthermore, while six stations A, B, C, D, E, and F are formed between the carrying-in section 102 and the taking-out section 104, the fixture 10 is installed on each stations A, B, C, D, and E and F. And are prepared by the processing machine 12 and it is in the both sides of each stations A, B, C, D, E, and F.
[0069] Here, the outline of the posture inverters 15 and 17 mentioned above, a fixture 10, and the processing machine 12 is explained.
[0070] First, the outline of the posture inverters 15 and 17 is explained. The posture inverter 15 is the same as the posture inverter 105 explained in the column of the conventional technique about the outline, although it differs in that the engine cylinder head 200 held with the "erection posture" as compared with the posture inverter 105 explained in the column of the conventional technique is changed into the posture (henceforth a "horizontal standing position") shown in drawing 13 . Moreover, the posture inverter 17 is the same as the posture inverter 107 explained in the column of the conventional technique about the outline, although it differs in that the engine cylinder head 200 held with the "horizontal standing position" shown in drawing 13 as compared with the posture inverter 107 explained in the column of the conventional technique is changed into an "erection posture."
[0071] That is, since both of the posture inverters 15 and 17 are common about the point of changing the posture of the engine cylinder head 200 between an "erection posture" and a "horizontal standing position", the structure is completely the same, and it is installed in the carrying-in section 102 and the taking-out section 104 so that each other may be made to face. If it carries out from this viewpoint, it is

communalized, and design costs become cheap and both of the posture inverters 15 and 17 can call it what contributes to reduction of an initial cost.
[0072] Next, the outline of a fixture 10 is explained, referring to drawing 2 - drawing 9. Drawing 2 is the front view of a fixture 10. Moreover, drawing 3 is the rear view of a fixture 10. Moreover, drawing 4 is the top view having shown the datum level 32 of the body 25 of a fixture 10. Moreover, drawing 5 and drawing 6 are the sectional views having shown the outline of the drive system of the ROKETO member 49 of a fixture 10. Moreover, drawing 7 is the side elevation of a fixture 10.
[0073] Moreover, in order to make an understanding of a fixture 10 easy, while the perspective view which looked at the fixture 10 from the transverse-plane side is shown in drawing 8 , the perspective view which looked at the fixture 10 from the tooth-back side is shown in drawing 9 . However, the fixture 10 shown in drawing 8 and drawing 9 is another thing to the engine cylinder head of 4-cylinder 4 bulb which does not receive the engine cylinder head 200 of 6-cylinder 4 bulb of drawing 14 , and is not illustrated. Therefore, between the fixture 10 shown in drawing 7 from drawing 2 , and the fixture 10 shown in drawing 8 and drawing 9 , the configurations of the components which correspond mutually may differ or corresponding components may not exist. In addition, about the components which correspond mutually, the same sign is used here from a viewpoint which makes an understanding of a fixture 10 easy.
[0074] And the fixture 10 installed in each stations A, B, C, D, E, and F has the adherence section 31 which insists upon the engine cylinder head 200, as shown in drawing 7 . This adherence section 31 is sent out while an engine cylinder 200 is sent with a "horizontal standing position", and it consists of a clamper 34 which is a clamp member for making a datum plane 32 carry out the plane of composition of the rail 33 and the engine cylinder head 200 of the rod type which supports and maintains the engine cylinder head 200 which carries out a plane of composition at the datum plane 32 as for which a part of engine cylinder head 200 carries out a plane of composition, and a datum plane 32, a cylinder 35 which is the driving source of a clamper 34.
[0075] In addition, as it is shown in drawing 3 in order to make it each tool (not shown) of a machine tool 12 arrive to the engine cylinder head 200 upon which it insisted in the fixture 10 for example, opening 37 is formed in datum level 32. Moreover, as shown in drawing 2 , the opening 36 for making it each tool (not shown) of a machine tool 12 arrive is formed also in the clamper 34 side with opposite datum level 32. Moreover, as shown in drawing 7 , two rails 22 of the rod type which contacts the engine cylinder head 200 of the opposite side, and the rail 23 of a rod form which supports and maintains the engine cylinder head 200 are formed in the clamper 34 side in the datum plane 32. However, in the jig 10 of drawing 8 and drawing 9 , the rail 24 of a rod form which contacts the near engine cylinder head 200 of a datum plane 32 by the datum-plane 32 side is formed. Moreover, the rails 23 and 33 which support and maintain the engine cylinder head 200 are not the configurations of a rod form.
[0076] And for example, as shown in drawing 2 , the body 25 which has the attaching part 31 mentioned above is supported to revolve with the bearing 26 in which the both sides were prepared by the stand 27. Moreover, above the stand 27, the driving cylinder 30 which extrudes with a servo motor 29 or is made to draw supports the ball screw 28 rotatable through the support section 41. Furthermore, the tip 42 of the ball screw 28 of a driving cylinder 30 is connected with the side face of a body 25 rotatable.
[0077] Therefore, in a driving cylinder 30, as shown in drawing 7 , if a ball screw 28 is made to draw with a servo motor 29, a body 25 will rotate clockwise and will incline. And when the part leans a body 25 even to the body 46 shown with the two-dot chain line, the engine cylinder 200 of a "horizontal standing position" can be made into an "inspired air flow path inclination posture." In addition, the driving cylinder 30 at this time is clockwise rotated focusing on the support section 41, and that center line 43 inclines even to a center line 44. Moreover, if the reverse is made to extrude a ball screw 28 with a servo motor 29, a body 25 will rotate counterclockwise and will incline. And when the part leans a body 25 even to the body 47 shown with the two-dot chain line, the engine cylinder 200 of a "horizontal standing position" can be made into a "exhaust side inclination posture." In addition, the driving cylinder 30 at this time is counterclockwise rotated focusing on the support section 41, and that center line 43

inclines even to a center line 45.
[0078] Moreover, for example, as shown in drawing 4 , six outlets 48 are formed in the datum-level 32 side of a body 25. Coolant liquid and the compressed air for washing blow off from these outlets 48. In addition, the coolant liquid for washing removes the swarf adhering to the engine cylinder head 200 etc., and it is being used for it in order to make datum level 32 carry out the plane of composition of the engine cylinder head 200 certainly. Moreover, the compressed air is used for judging extent of the plane of composition of the engine cylinder head 200 to a datum plane 32 according to the leakage condition from an outlet 48.
[0079] Moreover, for example, as shown in drawing 4 , the ROKETO member 49 with a locator pin 50 is formed in the inner both sides of a body 25. And as shown in drawing 5 and drawing 6 which are the fragmentary sectional view cut by the R-R line of drawing 4 , the ROKETO member 49 is extruded or (refer to drawing 5) drawn by the cylinder 51, showing around at two axial pins 52 (refer to drawing 6). Thereby, it can be made to insert [locator pin / 50 / of the ROKETO member 49] to the locating hole (not shown) of the engine cylinder 200 of an attaching part 31. In addition, in the jig 10 of drawing 8 and drawing 9 , the ROKETO member 49 of a different configuration is used and it is in the arrangement (a location, die length, etc.) from which the locator pin 50 of this ROKETO member 49 also differs.
[0080] Next, the outline of the processing machine 12 is explained, referring to drawing 10 R> 0, drawing 11 , and drawing 12 . Drawing 10 is the front view having shown the outline of the processing machine 12 prepared in the both sides of each stations A, B, C, E, F, and G from the Z-axis. Moreover, drawing 11 is the front view having shown the outline of the processing machine 12 prepared in the both sides of each stations A, B, C, E, F, and G from the X-axis. Furthermore, drawing 12 is the fragmentary sectional view which cut only housing 62 by the S-S line of drawing 10 . The processing machine 12 processes the functional holes 201A, 201B, and 201C of the engine cylinder head 200 upon which the fixture 10 insisted with the "inspired air flow path inclination posture", or the functional holes 202A, 202B, and 202C of the engine cylinder head 200 upon which the fixture 11 insisted with the "exhaust side inclination posture."
[0081] Moreover, by the processing machine 12, as shown in drawing 10 and drawing 11 , the spindle head 63 and the motor 64 are being fixed in the housing 62 attached on XZ shaft delivery unit 61. In this housing 62, it has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 (refer to drawing 14), and two spindle heads 63 and two motors 64 are being fixed. Moreover, one spindle 66 (refer to drawing 12) is dedicated to the interior of a spindle head 63. Furthermore, as shown in drawing 12 , within housing 62, the spindle 66 of a spindle head 63 is connected with the motor 64 by coupling 65.
[0082] Therefore, it can be made to rotate by one motor 64 through coupling 65 about one spindle 66 dedicated in the spindle head 63. Therefore, it becomes possible to rotate each tool (not shown) attached in the axis end of this spindle 66. Furthermore, each rotating tool (not shown) can be sent out to coincidence through XZ shaft delivery unit 61, being controlled with XZ shaft. By these, it becomes processible by each tool (not shown) attached in the axis end of a spindle 66. In addition, about each tool (not shown), the thing according to the magnitude of the path of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C used as the candidate for processing, the process of processing, etc. is attached to the axis end of each spindle 66.
[0083] Next, the transfer machine 1 with such an outline explains how to process the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200. First, in the roller conveyor 108 of the carrying-in section 102, the engine cylinder head 200 of an "erection posture" is carried in. And the engine cylinder head 200 on a roller conveyor 108 is horizontally extruded by the cylinder which is not illustrated with an "erection posture", and is pushed on the attaching part of the posture inverter 15 in it.
[0084] With the posture inverter 15, if the engine cylinder head 200 is pushed on an attaching part, the engine cylinder head 200 held at the attaching part will be changed into a "horizontal standing position" from an "erection posture" by the same mechanism as the posture inverter 105 explained in the column

of the conventional technique. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part is caught from the bottom, is horizontally conveyed with a "horizontal standing position", and is sent to the adherence section 31 of the fixture 10 of Station A.
[0085] When the engine cylinder head 200 of a "horizontal standing position" is sent to the adherence section 31, extrude the rod of a cylinder 35, the engine cylinder head 200 is made to press the clamp pin 21 of a clamper 34, and datum level 32 is made to carry out the plane of composition of a part of engine cylinder head 200 in the fixture 10 of Station A. Extrude the rod of a cylinder 51 to coincidence, it is made to insert the locator pin 50 of the ROKETO member 49 in the locating hole (not shown) of the engine cylinder head 200, and datum level 32 is made to carry out the plane of composition of the engine cylinder head 200 to it by the position. And the transformer bar which is not illustrated is retreated to the bottom. Thereby, the engine cylinder head 200 is correctly fixed with a "horizontal standing position."
[0086] Furthermore, in a driving cylinder 30, the engine cylinder 200 of a "horizontal standing position" is made into an "inspired air flow path inclination posture" by making a ball screw 28 draw with a servo motor 29. Thereby, the engine cylinder head 200 is correctly fixed with an "inspired air flow path inclination posture", and the "axis 201" of the engine cylinder head 200 will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, by controlling by XZ shaft delivery unit 61 of the machine tool 12 in the both sides of Station A, it sends out so that the "axis 201" top may be met.
[of the engine cylinder head 200 upon which it insisted the tool (not shown) attached in the axis end of the spindle 66 dedicated in the spindle head 63 in the fixture 10]
[0087] This becomes processible [the functional holes 201A, 201B, and 201C of the engine cylinder head 200 upon which it insisted in the fixture 10]. However, at Station A, functional hole 201A is roughed by one side of the machine tool 12 in the both sides, and functional hole 201C is roughed on the other hand. And two spindles 66 which two spindle heads 63 were fixed to the housing 62 of a machine tool 12, and were dedicated in these spindle heads 63, respectively From having stood in a line with pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 Each tool (not shown) attached in the axis end of two spindles 66, respectively has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, and is sent out to coincidence. Therefore, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201A is performed to coincidence by 1 time of the send in one machine tool 12 at this time. Moreover, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 201C is similarly performed to coincidence by 1 time of the send by the machine tool 12 of another side.
[0088] However, the engine cylinder head 200 is the thing of 6-cylinder 4 bulb, and since two intake valves are installed inside to one a "combustion chamber", the two "axes 201" exists in one a "combustion chamber" (refer to drawing 14). That is, the 12 "axes 201" will exist in the one engine cylinder head 200 which has six "combustion chambers." On the other hand in processing mentioned above, it is carried out in the one engine cylinder head 200 about the functional holes 201A and 201C with which it is dotted in serial focusing on the two "axes 201" among the 12 "axes 201", and is a request.
[0089] Then, processing of the functional holes 201A and 201C with which it is dotted in serial focusing on the remaining "axis 201" is performed by setting after that and controlling the tool (not shown) further attached in the axis end of the spindle 66 dedicated in the spindle head 63 by XZ shaft delivery unit 61 of a machine tool 12. Therefore, at Station A, roughing of send out, namely, according to one machine tool 112 functional hole 201in one machine tool 12 A is performed 6 times. Similarly, roughing of send out, namely, according to machine tool 12 of another side functional hole 201C in the machine tool 12 of another side is performed 6 times. Thereby, at Station A, roughing is performed about all the functional hole 201A of the engine cylinder head 200, and functional hole 201C.
[0090] Thus, termination of processing in Station A returns the engine cylinder 200 of an "inspired air flow path inclination posture" to a "horizontal standing position" by making a ball screw 28 extrude with a servo motor 29 in a driving cylinder 30 in the fixture 10 of Station A. And the rod of a cylinder 35 is

drawn and the clamp pin 21 of a clamper 34 is pulled apart from the engine cylinder head 200. The rod of a cylinder 51 is drawn in coincidence and the locator pin 50 of the ROKETO member 49 is removed from the locating hole (not shown) of the engine cylinder head 200. Thereby, the plane of composition over the datum level 32 of the engine cylinder head 200 can be made to cancel. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 31 is caught from the bottom, is horizontally conveyed with a "horizontal standing position", and is sent to the adherence section 31 of the fixture 10 of Station B.

[0091] Also at Station B, it is performed that it is the same as that of the station A mentioned above. However, the point of roughing functional hole 201B by one side of the machine tool 12 in the both sides, and roughing finish of functional hole 201B on the other hand after **** differs from the point that the engine cylinder head 200 is sent to the adherence section 31 of the fixture 10 of Station C after this processing termination. Moreover, also at Station C, it is performed that it is the same as that of the station A mentioned above. However, the point of performing finish of functional hole 201C on the other hand while finish-machining functional hole 201A by one side of the machine tool 12 in the both sides differs from the point that the engine cylinder head 200 is sent to the adherence section 31 of the fixture 10 of Station D after this processing termination. As mentioned above, it means that processing of all the functional holes 201A, 201B, and 201C was performed in the engine cylinder head 200 sent to the adherence section 31 of the fixture 10 of Station D.

[0092] Next, when the engine cylinder head 200 of a "horizontal standing position" is sent to the adherence section 31, extrude the rod of a cylinder 35, the engine cylinder head 200 is made to press the clamp pin 21 of a clamper 34, and datum level 32 is made to carry out the plane of composition of a part of engine cylinder head 200 in the fixture 10 of Station D. Extrude the rod of a cylinder 51 to coincidence, it is made to insert the locator pin 50 of the ROKETO member 49 in the locating hole (not shown) of the engine cylinder head 200, and datum level 32 is made to carry out the plane of composition of the engine cylinder head 200 to it by the position. And the transformer bar which is not illustrated is retreated to the bottom. Thereby, the engine cylinder head 200 is correctly fixed with a "horizontal standing position."

[0093] Furthermore, in a driving cylinder 30, the engine cylinder 200 of a "horizontal standing position" is made into a "exhaust side inclination posture" by making a ball screw 28 extrude with a servo motor 29. Thereby, the engine cylinder head 200 is correctly fixed with a "exhaust side inclination posture", and the "axis 202" of the engine cylinder head 200 will be in a condition parallel to the Z-axis on the flat surface formed with XZ shaft. Then, by controlling by XZ shaft delivery unit 61 of the machine tool 12 in the both sides of Station D, it sends out so that the "axis 202" top may be met. [of the engine cylinder head 200 upon which it insisted the tool (not shown) attached in the axis end of the spindle 66 dedicated in the spindle head 63 in the fixture 10]

[0094] This becomes processible [the functional holes 202A, 202B, and 202C of the engine cylinder head 200 upon which it insisted in the fixture 10]. However, at Station D, functional hole 202A is roughed by one side of the machine tool 12 in the both sides, and functional hole 202C is roughed on the other hand. And two spindles 66 which two spindle heads 63 were fixed to the housing 62 of a machine tool 12, and were dedicated in these spindle heads 63, respectively From having stood in a line with pitch spacing of six the "combustion chambers" established in the engine cylinder head 200 Each tool (not shown) attached in the axis end of two spindles 66, respectively has pitch spacing of six the "combustion chambers" established in the engine cylinder head 200, and is sent out to coincidence. Therefore, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 202A is performed to coincidence by 1 time of the send in one machine tool 12 at this time. Moreover, in each of two the "combustion chambers" established in the engine cylinder head 200, roughing of each functional hole 202C is similarly performed to coincidence by 1 time of the send by the machine tool 12 of another side.

[0095] However, the engine cylinder head 200 is the thing of 6-cylinder 4 bulb, and since two exhaust air bulbs are installed inside to one a "combustion chamber", the two "axes 202" exists in one a "combustion chamber" (refer to drawing 14). That is, the 12 "axes 202" will exist in the one engine

cylinder head 200 which has six "combustion chambers." On the other hand in processing mentioned above, it is carried out in the one engine cylinder head 200 about the functional holes 202A and 202C with which it is dotted in serial focusing on the two "axes 202" among the 12 "axes 202", and is a request.

[0096] Then, processing of the functional holes 202A and 202C with which it is dotted in serial focusing on the remaining "axis 202" is performed by setting after that and controlling the tool (not shown) further attached in the axis end of the spindle 66 dedicated in the spindle head 63 by XZ shaft delivery unit 61 of a machine tool 12. Therefore, at Station D, roughing of send out, namely, according to one machine tool 112 functional hole 202in one machine tool 12 A is performed 6 times. Similarly, roughing of send out, namely, according to machine tool 12 of another side functional hole 202C in the machine tool 12 of another side is performed 6 times. Thereby, at Station D, roughing is performed about all the functional hole 202A of the engine cylinder head 200, and functional hole 202C.

[0097] Thus, termination of processing in Station D makes the engine cylinder 200 of a "exhaust side inclination posture" a "horizontal standing position" by making a ball screw 28 draw with a servo motor 29 in a driving cylinder 30 in the fixture 10 of Station D. And the rod of a cylinder 35 is drawn and the clamp pin 21 of a clamper 34 is pulled apart from the engine cylinder head 200. The rod of a cylinder 51 is drawn in coincidence and the locator pin 50 of the ROKETO member 49 is removed from the locating hole (not shown) of the engine cylinder head 200. Thereby, the plane of composition over the datum level 32 of the engine cylinder head 200 can be made to cancel. Then, with the transformer bar which is not illustrated, the engine cylinder head 200 held at the attaching part 31 is caught from the bottom, is horizontally conveyed with a "horizontal standing position", and is sent to the adherence section 31 of the fixture 10 of Station E.

[0098] Also at Station E, it is performed that it is the same as that of the station D mentioned above. However, the point of roughing functional hole 202B by one side of the machine tool 12 in the both sides, and roughing finish of functional hole 202B on the other hand after **** differs from the point that the engine cylinder head 200 is sent to the adherence section 31 of the fixture 10 of Station F after this processing termination. Moreover, also at Station F, it is performed that it is the same as that of the station D mentioned above. However, the point of performing finish of functional hole 202C on the other hand while finish-machining functional hole 202A by one side of the machine tool 12 in the both sides differs from the point that the engine cylinder head 200 is sent to the attaching part of the posture inverter 17 of the taking-out section 104 after this processing termination.

[0099] In addition, conveyance horizontally performed in the engine cylinder head 200 with the transformer bar which is not illustrated with a "horizontal standing position" Conveyance to the fixture 10 of Station A from the posture inverter 15, conveyance to the fixture 10 of Station B of Station A from a fixture 10, Conveyance to the fixture 10 of Station C of Station B from a fixture 10, Conveyance to the fixture 10 of Station D of Station C from a fixture 10, Conveyance to the fixture 10 of Station E of Station D from a fixture 10, Both conveyance to the fixture 10 of Station F of Station E from a fixture 10 and conveyance to the posture inverter 17 of the taking-out section 104 from the fixture 10 of Station F are performed by one transformer bar in synchronization.

[0100] As mentioned above, it means that it means that processing of all the functional holes 202A, 202B, and 202C was performed, it has, and all processings of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 were completed in the engine cylinder head 200 sent to the taking-out section 104. After that, the engine cylinder head 200 held at the attaching part of the posture inverter 17 of the taking-out section 104 is the same mechanism as the posture inverter 107 explained in the column of the conventional technique, is changed into an "erection posture" from a "horizontal standing position", and is horizontally extruded on a roller conveyor 109 by the cylinder which is not illustrated with an "erection posture." And it is taken out to the exterior of a transfer machine 1 by the roller conveyor 109.

[0101] In addition, if "the axis 201" and "an axis 202" of the engine cylinder head 200 are compared as shown in drawing 7 , "an axis 201" will be in a condition parallel to the Z-axis in a location higher than "an axis 202" on the flat surface formed with XZ shaft. Then, with the machine tool 12, in order to lose

the effect of this difference, as shown in drawing 10 and drawing 11 , the plate 70 is ****(ed) between XZ shaft delivery unit 61 and housing 62. That is, adjustment is performed with the thickness of a plate 70.

[0102] the monopodium (spindle 66) of two spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 of those width at each stations A, B, C, D, E, and F in the transfer machine 1 of the gestalt of this operation as explained to the detail above -- it connects with one motor 64 by coupling 65, respectively (refer to drawing 12). And when the engine cylinder head 200 which is work is fixed with a fixture 10 on each stations A, B, C, D, and E and F, each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively can be rotated by rotating the monopodium (spindle 66) of each spindle head 63 by each motor 64. Furthermore, each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively can be sent out to coincidence by XZ shaft delivery unit 61.

[0103] Thereby, at Station A, it is 1 time of a send and two roughing of functional hole 201A or two functional hole 201C can be roughed to the one engine cylinder head 200 at coincidence. Moreover, at Station B, it is 1 time of a send and two roughing of functional hole 201B or two finish of functional hole 201B can be performed to coincidence to the one engine cylinder head 200. Moreover, at Station C, it is 1 time of a send and two finish of functional hole 201A or finish of two functional hole 201C can be performed to coincidence to the one engine cylinder head 200.

[0104] Moreover, at Station D, it is 1 time of a send and two roughing of functional hole 202A or two functional hole 202C can be roughed to the one engine cylinder head 200 at coincidence. Moreover, at Station E, it is 1 time of a send and two roughing of functional hole 202B or two finish of functional hole 202B can be performed to coincidence to the one engine cylinder head 200. Moreover, at Station F, it is 1 time of a send and two finish of functional hole 202A or finish of two functional hole 202C can be performed to coincidence to the one engine cylinder head 200.

[0105] At this time, to the monopodium (spindle 66) of a spindle head 63, and coupling of one motor 64, 65 the connection to depend From the belt coupling explained in the column of the conventional technique being what can be performed independently of other spindle head 63 and other motors 64 with the monotonous structure (refer to drawing 21) It can perform easily increasing or reducing the number of each spindle heads 63 put in order by XZ shaft delivery unit top 61, without large-converting. And the spindle head 63 and motor 64 which were set as the object of increase and decrease, and coupling 65 grade can be supplied and diverted among other transfer machines 1. The change in the spindle head 63 arranged in on XZ shaft delivery unit 61 after manufacture of a transfer machine 1 is attained by this, and it sets to each stations A, B, C, D, E, and F. The number of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C processed into coincidence by 1 time of the send can be changed to the one engine cylinder head 200.

[0106] Namely, if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 is made to increase, since the number of the tools (not shown) sent out to coincidence in XZ shaft delivery unit 61 can be made to increase At each stations A, B, C, D, E, and F, the number of the functional holes 201A, 201B, 201C, 202A, 202B, and 202C processed into coincidence by 1 time of the send also increases to the one engine cylinder head 200.

[0107] Therefore, it sets like the gestalt of this operation to the machine tool 12 of one side of each stations A, B, C, D, E, and F. To the one engine cylinder head 200 by the case where 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) must be processed When the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 concerned is two Since the number of the tools (not shown) sent out to coincidence in the XZ shaft delivery unit 61 concerned is also two In order to process 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) to the one engine cylinder head 200, it is necessary to perform the coincidence send of each tool (not shown) by the XZ shaft delivery unit 61 concerned 6 times.

[0108] however, at the time of three pieces which increased the one number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 concerned, for example Since the number of the tools (not shown) sent out to coincidence in the XZ shaft delivery unit 61 concerned also

increases to three pieces What is necessary is just to perform the coincidence send of each tool (not shown) by the XZ shaft delivery unit 61 concerned 4 times, in order to process 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) to the one engine cylinder head 200. furthermore, at the time of six pieces which increased the three number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 of the machine tool 12 concerned Since the number of the tools (not shown) sent out to coincidence in the XZ shaft delivery unit 61 concerned also increases to six pieces What is necessary is just to perform the coincidence send of each tool (not shown) by the XZ shaft delivery unit 61 concerned twice, in order to process 12 functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) to the one engine cylinder head 200.

[0109] Thus, if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 is made to increase, since it can decrease the count of a coincidence send of each tool (not shown) by XZ shaft delivery unit 61 and time amount required for processing in each stations A, B, C, D, E, and F will be shortened, the maximum production capacity of a transfer machine 1 can be raised. Therefore, also after a transfer machine 1 is manufactured, the maximum production capacity of a transfer machine 1 can be reinforced by making the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 increase. When the maximum production size which shall be equivalent to the usual volume which it becomes impossible that it is not necessary to make the maximum production capacity of a transfer machine 1 fully correspond [volume] to the maximum production size expected by this, and has the original maximum production capacity expected, and is expected becomes actual, it becomes possible to reinforce the original maximum production capacity.

[0110] On the contrary, if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 is decreased, since the number of the tools (not shown) sent out to coincidence in XZ shaft delivery unit 61 can be decreased At each stations A, B, C, D, E, and F, the number of the functional holes (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) processed into coincidence by 1 time of the send also decreases to the one engine cylinder head 200. Therefore, also after a transfer machine 1 is manufactured, the maximum production capacity of a transfer machine 1 can be made to reduce by decreasing the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61. In addition, the same effectiveness can be demonstrated even if the number of the spindle heads 63 arranged in on XZ shaft delivery unit 61 becomes one piece.

[0111] As mentioned above, since the original maximum production capacity can be suppressed low, it can contribute to reduction of an initial cost. Moreover, when reinforcing the maximum production capacity after that, while a spindle head 63, a motor 64, coupling 65, etc. which became unnecessary with other transfer machines 1 can be diverted, when decreasing a volume, it not only corresponds by enlarging the pitch time of the engine cylinder head 200 conveyed at each stations A, B, C, D, E, and F, but it can respond by making the maximum production capacity reduce. And when making the maximum production capacity reduce, a spindle head 63, a motor 64, coupling 65, etc. which became unnecessary can be made to divert to other transfer machines 1. Therefore, new plant-and-equipment investment hardly starts in the case of enhancement and reduction of the maximum production capacity.

[0112] Furthermore, since that to which supply, the spindle head 63 diverted, a motor 64, coupling 65, etc. were common among other transfer machines 1 is used in the transfer machine 1 concerned, design costs become cheap. Moreover, since the connection structure by coupling 65 is monotonous and there are also few component part mark, manufacture costs become cheap. Also from these viewpoints, it can contribute to reduction of an initial cost.

[0113] Moreover, as shown in drawing 10 or drawing 12 , in case the monopodium (spindle 66) of a spindle head 63 is arranged in on XZ shaft delivery unit 61, it is carried out through the housing 62 attached on XZ shaft delivery unit 61. The location where two spindle heads 63 are fixed in juxtaposition is beforehand established in this housing 62 at intervals of the predetermined pitch (pitch spacing of six the "combustion chambers" established in the engine cylinder head 200), and it makes it still easier to fluctuate the spindle head 63 arranged in on XZ shaft delivery unit 61 free. In addition, when making the number of these spindle heads 63 into three or more pieces, housing 62 is exchanged to what can fix three or more spindle heads 63. Pitch spacing (pitch spacing of six the "combustion

chambers" established in the engine cylinder head 200) of the spindle head 63 arranged in on XZ shaft delivery unit 61 is secured by this, and it sets to each stations A, B, C, D, E, and F. the functional hole (201A --) processed into coincidence by 1 time of the send to the one engine cylinder head 200 Security of those pitch spacing (pitch spacing of six the "combustion chambers" established in the engine cylinder head 200) is made about any one of 201B, 201C, 202A, 202B, and the 202C.

[0114] Therefore, by exchanging the housing 62 attached on XZ shaft delivery unit 61 in other housing 62 with which the values of pitch spacing differ Can enable a setup of pitch spacing of the spindle head 63 arranged in on XZ shaft delivery unit 61, have, and it sets to each stations A, B, C, D, E, and F. It becomes possible to the one engine cylinder head 200 to change those pitch spacing about the functional hole (any one of 201A, 201B, 201C, 202A, 202B, and the 202C) processed into coincidence by 1 time of the send.

[0115] Especially the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 Usually by the engine Taki cylinder-ization, more than one are prepared at equal intervals. This pitch spacing Since it is different with the class of engine cylinder head 200 in many cases, in changing to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, it needs modification of pitch spacing of the monopodium (spindle 66) of a spindle head 63 in many cases. And without converting sharply modification of pitch spacing of the monopodium (spindle 66) of a spindle head 63 at this time, since it can do only by exchanging housing 62, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.

[0116] Moreover, each stations A, B, C, D, and E and the jig 10 installed on F can control the inclination posture freely, insisting upon the engine cylinder head 200 (refer to drawing 7). Therefore, at each stations A, B, C, D, E, and F, whenever [tilt-angle / of the functional hole (any one of 201A, 201B 201C 202A, 202B, and the 202C) processed into coincidence by 1 time of the send] can be changed to the one engine cylinder head 200.

[0117] In order to secure the function, especially the functional holes 201A, 201B, 201C, 202A, 202B, and 202C of the engine cylinder head 200 have many which are inclined and prepared, and since whenever [this tilt-angle] is usually different with the class of engine cylinder head 200, when changing to the engine cylinder head of the class from which the engine cylinder head 200 differs, they need modification of the inclination posture of the engine cylinder head 200 in many cases. And since it can do only in control by the fixture 10, without modification of the inclination posture of the engine cylinder head 200 converting a fixture 10 sharply at this time, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.

[0118] Moreover, whenever [tilt-angle / of the engine cylinder head 200] Like the gestalt of not only between the engine cylinder heads 200 of a different class but this operation for example, since it may be different also within the one engine cylinder head 200 like an "inspired air flow path inclination posture" and a "exhaust side inclination posture" Even if it is the same engine cylinder head 200, when the functional holes 201A, 201B, 201C, 202A, 202B, and 202C for processing differ, modification of the inclination posture of the engine cylinder head 200 is needed in many cases. At this time, and modification of the inclination posture of the engine cylinder head 200 The fixture 10 of dedication is not formed in every exhaust side inclination posture". the conventional technique -- like -- "an inspired air flow path inclination posture" -- "-- Since it can do only in control by the common fixture 10 at each stations A, B, C, D, E, and F, design costs become cheap by communalization of a fixture 10, and it can contribute to reduction of an initial cost.

[0119] Moreover, in each stations A, B, C, D, and E and the jig 10 installed on F, in case it insists upon the engine cylinder head 200, positioning of the engine cylinder head 200 is secured with the locator pin 50 prepared in the ROKETO member 49 (reference, such as drawing 4). And in this ROKETO member 49, arrangement conditions, such as a location of a locator pin 50 and die length, are determined so that it may correspond to the locating hole (not shown) prepared in the engine cylinder head 200. Therefore, the arrangement condition of a locator pin 50 can be changed by exchanging the ROKETO member 49

attached in a fixture 10 to other ROKETO members 49 from which the arrangement condition of a locator pin 50 differs.
[0120] Since the shape especially of surface type of the engine cylinder head 200 is different with the class of engine cylinder head 200 in many cases, in changing to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, the location of a locating hole (not shown) established in the engine cylinder head 200 is obliged to modification in many cases, and needs modification of the arrangement condition of a locator pin 50 in many cases. And without modification of the arrangement condition of a locator pin 50 converting a fixture 10 sharply at this time, since it can do only by exchanging the ROKETO member 49, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.
[0121] Moreover, in each stations A, B, C, D, and E and the jig 10 installed on F, in case it insists upon the engine cylinder head 200, it is insisting upon the engine cylinder head 200 by the clamp pin 21 prepared in the clamper 34 (reference, such as drawing 7). And in this clamper 34, arrangement conditions, such as a location of the clamp pin 21 and die length, are determined in consideration of the part by which a pressure welding is carried out to the engine cylinder head 200. Therefore, the arrangement condition of the clamp pin 50 can be changed by exchanging the clamper 34 attached in a fixture 10 to other clampers 34 from which the arrangement condition of the clamp pin 50 differs.
[0122] Since the shape especially of surface type of the engine cylinder head 200 is different with the class of engine cylinder head 200 in many cases, in changing to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, the part by which a pressure welding is carried out to the engine cylinder head 200 is obliged to modification in many cases, and needs modification of the arrangement condition of the clamp pin 21 in many cases. And without modification of the arrangement condition of the clamp pin 21 converting a fixture 10 sharply at this time, since it can do only by exchanging a clamper 34, even if it changes to the engine cylinder head 200 of the class from which the engine cylinder head 200 differs, an excessive additional investment is not needed.
[0123] namely, in the transfer machine 1 of the gestalt of this operation Since the change in the spindle head 63 arranged in on XZ shaft delivery unit 61 was enabled, enhancement and reduction of the maximum production capacity are attained after the manufacture and the original maximum production capacity can be suppressed low Since it can contribute to reduction of an initial cost and a spindle head 63, a motor 64, coupling 65, etc. can be diverted, while design costs are cheap and end Since new plant-and-equipment investment does not almost have this thing in the case of enhancement and reduction of the maximum production capacity, and the connection structure of a spindle head 63 or a motor 64 is monotonous, and the manufacture costs are also cheap and can finish it further It can respond by low cost to fluctuation of the volume of the engine cylinder head 200 which is work.
[0124] By moreover, exchange of housing 62, control by the fixture 10, exchange of the ROKETO member 49, and exchange of a clamper 34 The functional holes 201A, 201B, and 201C of the engine cylinder head 200, Modification of pitch spacing of 202A, 202B, and 202C, functional hole 201A of the engine cylinder head 200, Modification of whenever [tilt-angle / of 201B, 201C, 202A 202B, and 202C], Modification of the location of the locating hole (not shown) of the engine cylinder head 200, Since it can respond to modification of the pressure-welding part of the clamp pin 50 to the engine cylinder head 200 and an excessive additional investment is not needed in that case, it can respond by low cost to "a change of the engine cylinder head 200" which is work.
[0125] In addition, although it may be accompanied by program modification to control of XZ shaft delivery unit 61, modification of each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively, etc. in the case of fluctuation of the volume of the engine cylinder head 200 which is work, and "a change of the engine cylinder head 200" which is work, about them, each can respond by low cost.
[0126] Moreover, it sets to each stations A, B, C, D, and E and the jig 10 installed on F. From it being freely controllable, the inclination posture of the engine cylinder head 200 It becomes possible to make a "horizontal standing position" communalize the posture of the engine cylinder head 200 at the time of adherence by the fixture 10 being canceled at all stations. By this Since the posture of the engine

cylinder head 200 at the time of conveyance to each stations A, B, C, D, E, and F and taking out can also be made to communalize with a "horizontal standing position" The thing equivalent to the posture inverter 106 stated in the column of the conventional technique can be lost, and an initial cost can be low held down also from this viewpoint.

[0127] moreover, the time amount which the change in a spindle head 63, exchange of housing 62, exchange of the ROKETO member 49, and exchange of a clamper 34 take is markedly boiled compared with the time amount which large reconstruction of the conventional technique takes, since it is short, can prevent the shutdown of production over a long period of time, and can make profitability of plant-and-equipment investment high also from this viewpoint.

[0128] Moreover, by having lost the thing equivalent to the posture inverter 106 stated in the column of the conventional technique, it can become possible to also lose the pars intermedia 103 of drawing 18 , and the occupancy area of a transfer machine 1 can be decreased (refer to drawing 1).

[0129] As shown in drawing 12 , moreover, each of the monopodium (spindle 66) of a spindle head 63 Since it connects with one motor 64 by coupling 65 and has the configuration of the so-called motor direct drive of 1 shaft configuration Compared with the belt coupling explained in the column of the conventional technique (refer to drawing 21), each tool (not shown) attached in the axis end of the monopodium (spindle 66) of each spindle head 63, respectively can be rotated at high speed.

[0130] Furthermore, since facility height low ** can be stopped and the prospect nature of the whole facility becomes good compared with the transfer machine 100 which has the belt coupling explained in the column of the conventional technique by having the configuration of the so-called motor direct drive of 1 shaft configuration (R> drawing 21 1 reference), the transfer machine 1 of the gestalt of this operation can contribute to improvement in safety and integrity.

[0131] Moreover, a spindle head 63 can make the appearance configuration of a spindle head 63 a circle configuration for a monopodium. And the chip and coolant liquid at the time of cutting which becomes possible [equipping wrap covering only with a fixture 10], and generates the seal (scraper) of the circle configuration corresponding to the circle configuration in a fixture 10 can prevent dispersing to the exterior efficiently with this covering. That is, in the transfer machine 100 of the conventional technique, since the appearance configuration of a gearbox 141 is carrying out the rectangle and had covered the transfer machine 100 whole with covering triggered by the difficulty of the seal nature of this rectangle, in the transfer machine 1 of the gestalt of this operation, miniaturization of covering is attained and manufacture costs can be reduced.

[0132] Moreover, in conveyance with the transformer bar (not shown) in the transfer machine 100 of the conventional technique, the engine cylinder head 200 is conveyed with the "inspired air flow path inclination posture" or the "exhaust side inclination posture." However, in conveyance with the transformer bar (not shown) in the transfer machine 1 of the gestalt of this operation, the engine cylinder head 200 is conveyed with the "horizontal standing position", and it can be said that the stability at the time of conveyance is more excellent compared with an "inspired air flow path inclination posture" and a "exhaust side inclination posture." Therefore, in case it sends to the attaching part 31 of a fixture 10 or sends out, there is no possibility that the engine cylinder head 200 and a fixture 10 may interfere mutually, and may get damaged.

[0133] In addition, various modification is possible for this invention in the range which is not limited to the gestalt of the above-mentioned implementation and does not deviate from the meaning. For example, it sets to the roller conveyor 108 of the carrying-in section 102, and the roller conveyor 109 of the taking-out section 104. if it does not "erection posture" come out of the engine cylinder head 200 and is made to convey with a "horizontal standing position" Since the posture inverter 15 which changes the engine cylinder head 200 into a "horizontal standing position" from an "erection posture", and the posture inverter 17 which changes the engine cylinder head 200 into an "erection posture" from a "horizontal standing position" can be lost Furthermore, an initial cost can be held down low.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the front view having shown the outline of the transfer machine of this invention.
[Drawing 2] It is the front view having shown the fixture in the transfer machine of this invention.
[Drawing 3] It is the rear view having shown the fixture in the transfer machine of this invention.
[Drawing 4] It is the front view having shown the datum level of the body of the fixture in the transfer machine of this invention.
[Drawing 5] It is the fragmentary sectional view cut in the flat surface which meets the R-R line of drawing 4 , and the outline of the drive system of the ROKETO member of a fixture is shown.
[Drawing 6] It is the fragmentary sectional view cut in the flat surface which meets the R-R line of drawing 4 , and the outline of the drive system of the ROKETO member of a fixture is shown.
[Drawing 7] It is the side elevation having shown the fixture in the transfer machine of this invention.
[Drawing 8] What was shown in drawing 2 - drawing 7 is the perspective view which looked at a different fixture from the transverse-plane side.
[Drawing 9] It is the perspective view which looked at the fixture shown in drawing 8 from the tooth-back side.
[Drawing 10] It is the front view having shown the outline of the processing machine in the transfer machine of this invention from the Z-axis.
[Drawing 11] It is the front view having shown the outline of the processing machine in the transfer machine of this invention from the X-axis.
[Drawing 12] It is the fragmentary sectional view which cut only housing by the S-S line of drawing 10 .

[Drawing 13] It is the sectional view cut in the flat surface which meets the P-P line of drawing 14 , and is a thing at the time of the "horizontal standing position" of the engine cylinder head.
[Drawing 14] It is the top view having shown an example of the engine cylinder head from the "combustion chamber" side.
[Drawing 15] It is the sectional view cut in the flat surface which meets the P-P line of drawing 14 , and is a thing at the time of the "erection posture" of the engine cylinder head.
[Drawing 16] It is the sectional view cut in the flat surface which meets the P-P line of drawing 14 , and is a thing at the time of the "inspired air flow path inclination posture" of the engine cylinder head. It ****.
[Drawing 17] It is the sectional view cut in the flat surface which meets the P-P line of drawing 14 , and is a thing at the time of the "exhaust side inclination posture" of the engine cylinder head.
[Drawing 18] It is the front view having shown the outline of the transfer machine of the conventional technique.
[Drawing 19] It is the front view having shown the posture inverter in the transfer machine of the conventional technique.
[Drawing 20] It is the sectional view having shown the fixture in the transfer machine of the conventional technique.

[Drawing 21] It is the front view having shown the processing machine in the transfer machine of the conventional technique.
[Drawing 22] It is the sectional view cut in the flat surface which meets the Q-Q line of drawing 21 .
[Description of Notations]
1 Transfer Machine
10 Fixture
21 Clamp Pin
34 Clamper
49 ROKETO Member
50 Locator Pin
61 XZ Shaft Delivery Unit
62 Housing
63 Spindle Head
64 Motor
65 Coupling
66 Spindle
200 Engine Cylinder Head
201A, 201B, 201C, 202A, 202B, 202C Functional hole
A, B, C, D, E, F Station

[Translation done.]